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Available Coal Resources of the Salyersville South 7.5-Minute Quadrangle, Magoffin County, Kentucky

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John K. Hiett, and Richard E. Sergeant

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Cover Illustration
Three-dimensional topography of the Salyersville South Quadrangle viewed from the southeast.

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AVAILABLE COAL RESOURCES OF THE SALYERSVILLE SOUTH 7.5-MINUTE QUADRANGLE, MAGOFFIN COUNTY, KENTUCKY

Robert E. Andrews, Gerald A. Weisenfluh, John K. Hiett, and Richard E. Sergeant

SUMMARY

Coal resources available for mining have been estimated for the Salyersville South Quadrangle, which is located in the Licking River Coal Reserve District of the Eastern Kentucky Coal Field. Nine coal beds within the quadrangle are potentially mineable and constitute the basis of these resource estimates. Seven of these beds have been commercially developed, but only five have produced more than 1 million tons: from youngest to oldest, the Skyline A, Lower Broas, Lower Peach Orchard, Middle Peach Orchard, and Upper Peach Orchard. A computerized Geographic Information System was used to calculate estimates of original, mined-out, and remaining resources, as well as restrictions to mining and available resources.

Original Coal Resources

The total original coal resources calculated for the Salyersville South Quadrangle in this study were **183.4 million** short tons. Three beds, the Gun Creek, Fire Clay, and Lower Peach Orchard, make up 78 percent of this amount. Approximately **32 percent** of the total original resources are in the greater-than-28-inches thickness category. **Fifty-one percent** of the resources lie in the 100-to-1,000-feet overburden category. The average reliability of the estimates based on the density of data points is **19 percent measured, 44 percent indicated, 36 percent inferred, and 1 percent hypothetical.**

Mined-Out and Remaining Coal Resources

Total mined-out and lost-in-mining tonnages are **23.4 million** tons. Surface mining accounts for **99 percent** of this amount. The remaining resources are **160 million** tons or **87 percent** of the original. These resources are distributed similarly to the original resources with respect to overburden and thickness categories.

Restrictions and Available Coal Resources

The total restricted coal for the area is **79.4 million** tons, or **50 percent** of the remaining resources. Coal too thin to mine by underground methods (technological restriction) accounts for **83 percent** of this amount. The available coal resources are estimated as **80.6 million** tons, which is **44 percent** of original resources. The Lower Peach Orchard, Fire Clay, and Gun Creek coal beds constitute **73 percent** of the available resources; **42 percent** of these beds are in the less-than-100-feet overburden category.

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INTRODUCTION

One of the primary functions of the Federal and state geological surveys is to estimate the amount of the Nation's mineral resources. Understanding resource estimates and their inherent levels of uncertainty is crucial for policy makers who are involved with long-term economic planning. In Kentucky, one of the most important economic and energy resources is coal, which occurs in two regions of the State: the Eastern and Western Kentucky Coal Fields.

About 6.6 billion tons of coal have been mined in these two regions since the beginning of the nineteenth century. The amount of coal greater than 14 inches thick remaining in Kentucky is estimated to be about 91 billion tons, based on Brant and others (1983) and annual production figures. Given present production levels of about 160 million tons per year, the supply of coal in the Commonwealth appears to be endless. However, significant portions of this resource are not available for mining because of both regulatory statutes and adverse mining or geological conditions (Eggleston and others, 1990). Quantification of the degree to which these factors restrict the resource is important for making projections of the amount of coal resources available for future mining.

The objective of the Coal Availability Program is to measure, for selected areas, the magnitude of original resources before mining, past mining, and potential restrictions to future mining. Mined-out tonnages are classified on the basis of mining method: either surface or underground. Restrictions fall into two categories: land-use and technological. Land-use restrictions are specified by local, State, or Federal regulations and generally apply to surface mining. Examples are streams, roads, cemeteries, powerlines, municipalities, and areas adjacent to each of these restrictions, called buffer zones. Technological factors that restrict the development of coal, such as deep-mine buffers and adverse geological conditions, generally apply to underground mining.

Each analysis for the Eastern Kentucky Coal Availability Study is performed for one 7.5-minute quadrangle, an area of about 55 square miles or 38,000 acres. Estimates are presented for original, mined-out, remaining, restricted, and available resources for each quadrangle. This report describes the results for the Salyersville South Quadrangle in Magoffin County, Kentucky, the tenth project area in the Eastern Kentucky Coal Field.

LOCATION, GEOLOGY, AND MINING HISTORY

The Salyersville South Quadrangle is located in Magoffin County, Kentucky. The area has one municipality, Salyersville, and two villages, Sublett and Burning Fork. The only major highway running through the quadrangle is the Mountain Parkway.

The Salyersville South Quadrangle lies along the southeastern edge of the Licking River Coal Reserve District (Fig. 1). The area is dissected by the Licking River and the Little Fork Creek and its tributaries. The regional structural dip in the area is to the east at a rate of about 25 feet per mile. The maximum topographic relief within the quadrangle is about 550 feet (Spengler, 1977).

The principal coal beds of the area, as shown by Spengler (1977), from youngest to oldest, are the Gun Creek, Fire Clay, Prater A, Prater B, Lower Peach Orchard, Middle Peach Orchard, Upper Peach Orchard, Lower Broas, and Skyline. The thickness of this coal-bearing interval is about 550 feet (Fig. 2). Other coal beds occur in the quadrangle but are generally too thin and discontinuous to be of commercial value using present mining practices (Spengler, 1977).

The lowest coal bed in this study, the Gun Creek (Amburgy equivalent), lies below the Kendrick Shale Member (Fig. 2). This bed is exposed at the surface mainly in the northern part of the quadrangle and lies in the subsurface in the southwest and south. The Gun Creek is a multi-benched coal zone. Potentially mineable coal beds occur where two or more benches are merged, contain less than 50 percent partings, and are thicker than 14 inches, the minimum thickness for mining. Two northeast-trending coal bodies are found in the Salyersville South Quadrangle and appear to be the northern terminus of a larger coal body found immediately to the south in the Tiptop Quadrangle. The margins of the coal bodies are marked by the splitting of one or more of the bed's benches and channeling, represented by overlying sandstone deposits. These sandstone deposits cut out the lower two benches in the southwest and the upper two benches in the northeast (Fig. 3). Very little of the Gun Creek coal has been developed in the Salyersville South Quadrangle, probably because of the persistent in-seam partings and only modest coal thickness.

The Fire Clay coal bed (Hazard No. 4 equivalent) lies 100 feet above the Gun Creek (Fig. 2) and is exposed at the surface in the northern two-thirds of the quadrangle. This coal seam consists of three benches, with a

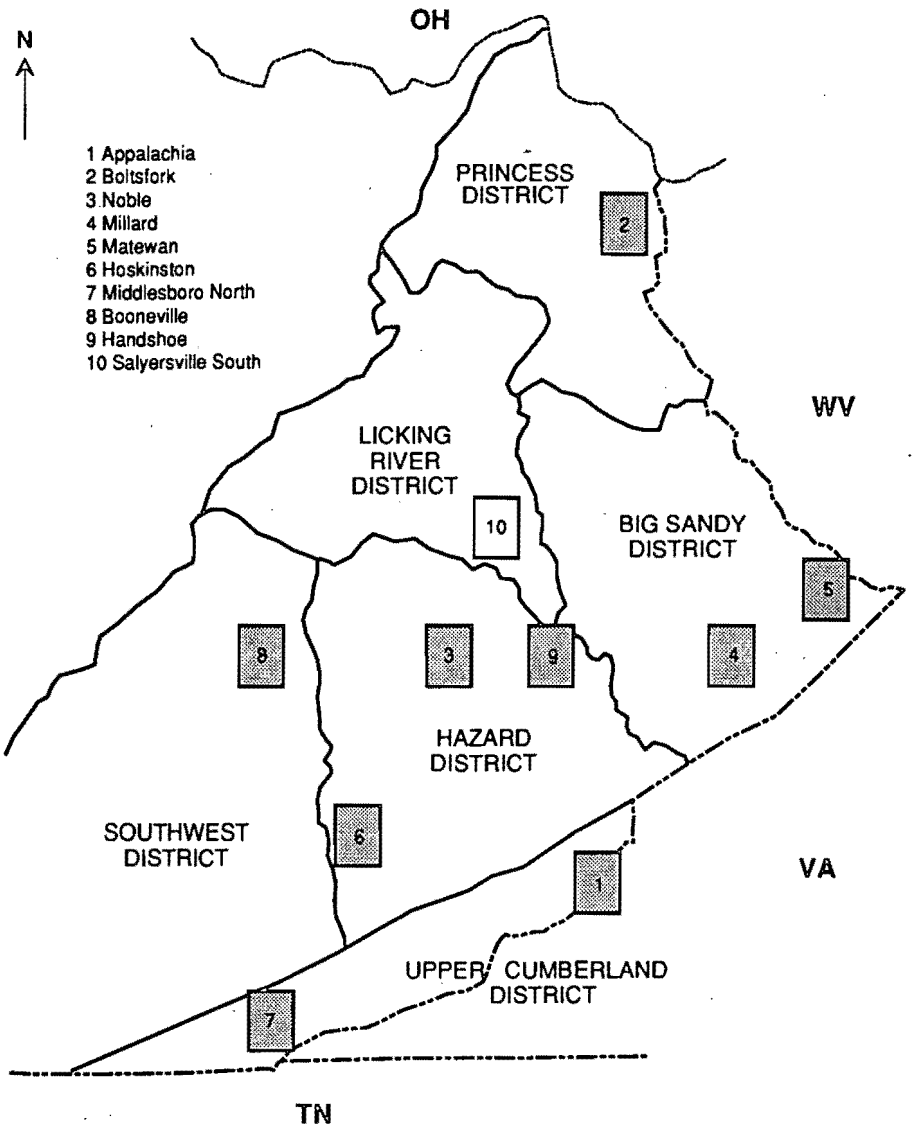


Figure 1. Location of the Salyersville South Quadrangle within the Eastern Kentucky Coal Field. Previously completed quadrangles (stippled) from the Coal Availability Program are shown relative to the six coal reserve districts. The study of the Appalachia Quadrangle was completed by the Virginia Division of Mineral Resources.

flint clay parting between the upper and middle benches. In the east-central part of the quadrangle, the benches are close together, with little or no additional rock partings. In all directions away from this area, rock partings develop between each bench. Figure 4 schematically illustrates these relationships. Very little mining has occurred in this bed; most mining consists of small household adits in the southern part of the quadrangle. Most commercial mining has been by contour surface methods, and a small amount by underground drift adits.

Sixty feet above the Magoffin Shale Member lies the Prater coal zone (Hazard equivalent) (Fig. 2). In most areas, this zone consists of two beds (Prater A and B) separated by 10 to 20 feet of strata. The beds reach mineable thicknesses in small areas; however, they do not appear to have significant continuity. The only mining in this zone has occurred in the form of contour stripping. A cross section of this zone is shown in the lower part of Figure 5.

The Lower, Middle, and Upper Peach Orchard beds (Fig. 2) constitute the Peach Orchard coal zone (Hazard No. 7 and 8 equivalents). This zone is about 40 to 60 feet thick in the Salyersville South Quadrangle. The lower bed is the thickest and most continuous. In the western part of the quadrangle a thin leader splits from the main bed. This leader is believed to eventually merge with the underlying Prater zone. The Middle Peach Orchard coal bed occurs mostly in the eastern part of the quadrangle. Toward the west this bed thins and possibly

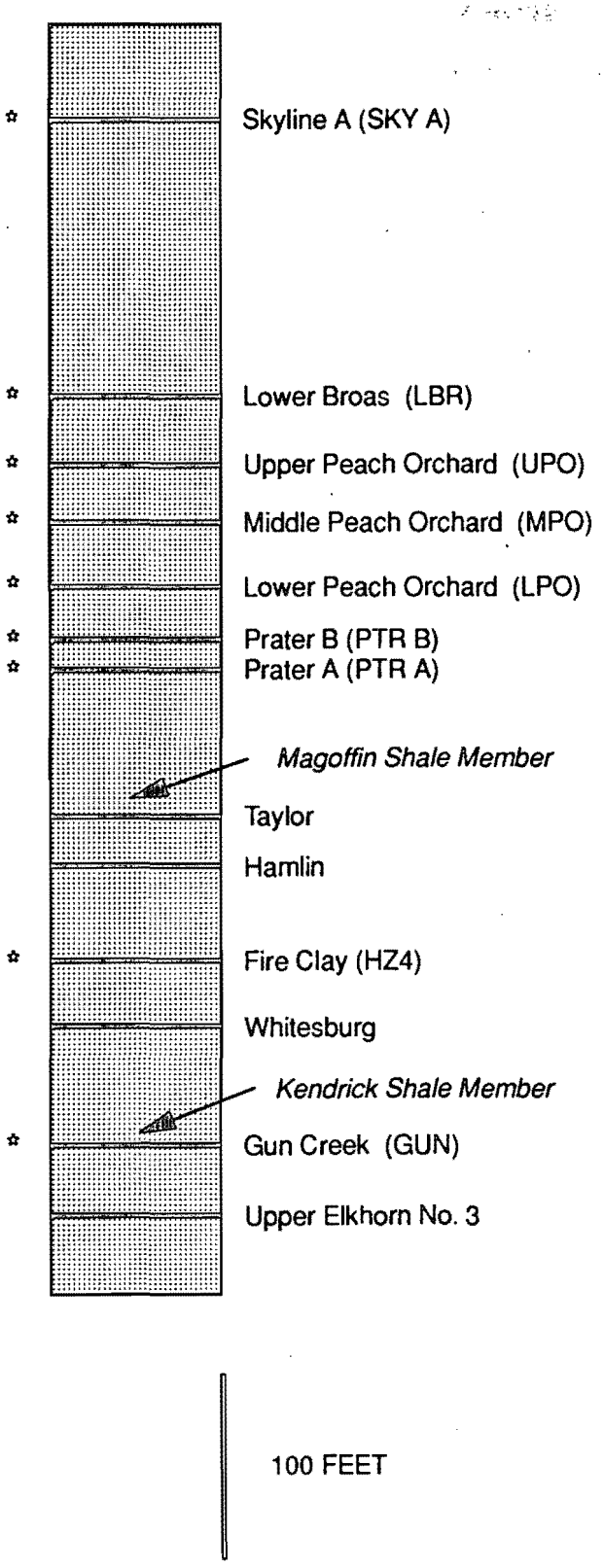


Figure 2. The coal beds of the Salyersville South Quadrangle. Asterisks indicate the beds for which resource estimates were prepared. Bed abbreviations in parentheses are those used in subsequent figures.

merges with the upper or lower beds of the zone. The vertical distance between this and the upper and lower beds varies from 20 to 40 feet. The upper bed of the zone is the thinnest and is made up of one or two coal benches, which in the eastern part of the quadrangle have rock partings varying from 0 to 10 feet thick. In the western part of the quadrangle this bed is made up of only one coal bench. A cross section of the zone is shown in Figure 5. Although the upper and middle beds are thin, they are still extensively mined because of their proximity to the lower bed. Most mining in the Peach Orchard zone is by contour strip, area, or mountaintop-removal methods.

The Lower Broas coal bed (Hazard No. 9 equivalent) (Fig. 2) is a single-benched coal with no partings that is continuous throughout its outcrop area in the quadrangle (Fig. 5). Mining of this bed has been by both contour and mountaintop-removal surface methods. In some cases this bed has been mined along with the Peach Orchard zone, because it occurs about 50 feet above the Upper Peach Orchard.

The uppermost coal zone in the quadrangle is the Skyline (Fig. 2). Mining permit records suggest the presence of three benches of the Skyline in this quadrangle. However, because of the lack of thickness data, only the lower bench, the Skyline A, was examined in this study. The Skyline A has only a small outcrop area in the southern third of the quadrangle. Mining for this seam has been by mountaintop removal methods.

METHODS

Approach

In order to estimate the amount of coal in a given area, its volume must be known. The two factors necessary for calculating volume are area, which is defined by the outcrop of the coal bed, and thickness, which is estimated from point measurements along the outcrop and in subsurface boreholes. The various resource categories, mined-out areas, and restrictions described below make up some part of the whole area of each coal bed. Because the primary task is determining and measuring map areas, a computerized Geographic Information System (GIS) approach was selected to perform the analysis. This type of system allows for digital map information to be stored and automated comparisons and calculations to be made on one or more maps. The primary effort of this type of study is preparing analog point-source and map information and rendering it in digital form.

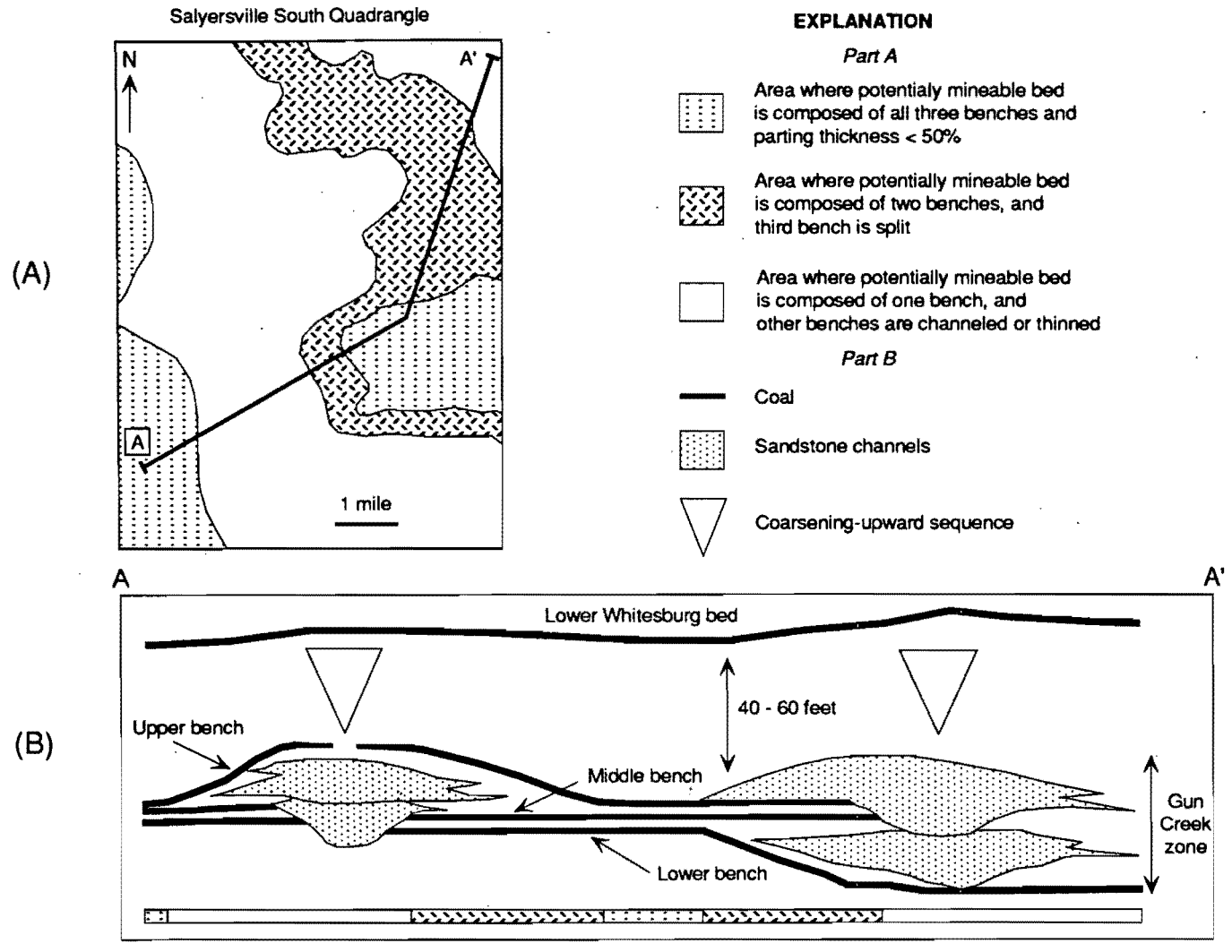


Figure 3. (A) The number of benches in the mineable portion of the Gun Creek zone in the Salyersville South Quadrangle. (B) Generalized cross section of the Gun Creek zone in the Salyersville South Quadrangle. Bar at bottom of part B associates portions of cross section with corresponding patterned areas in part A.

Data Preparation

Point Data

The coal-bed point data for the Salyersville South Quadrangle were obtained from measurements made by geologists and engineers at mines or outcrops and from exploration drill holes. These data include measurements of a coal bed's thickness, thickness of rock partings (if present), elevation (calculated from surveyed borehole elevations or estimated by altimeter or from topographic maps), and the stratigraphic position of the coal. The outcrop measurements were extracted from the Kentucky Geological Survey Coal Resource Information System (KCRIS) and the core data were processed and extracted using CMASTER, a borehole data-base software product. Additional information about the thickness and elevation of coal beds was obtained from surface-mine permits from the Kentucky Natural Resources and Environmental Protection Cabinet. All data were examined in order to verify correlations and accuracy in measurement. Many of the outcrop and mine localities were verified by field inspection. The locations and measurements were then prepared as digital data files; location coordinates were expressed in the Universal Transverse Mercator (UTM) system, thicknesses in decimal inches, and elevations in feet above sea level.

Map Data

The various types of map information were digitized from mylar tracings or photo reproductions using the program GSMAP (version 7.2). Coal-bed outcrops were determined from the Salyersville South 7.5-minute geologic quadrangle map (Spengler, 1977) and from surface and underground mine maps obtained from

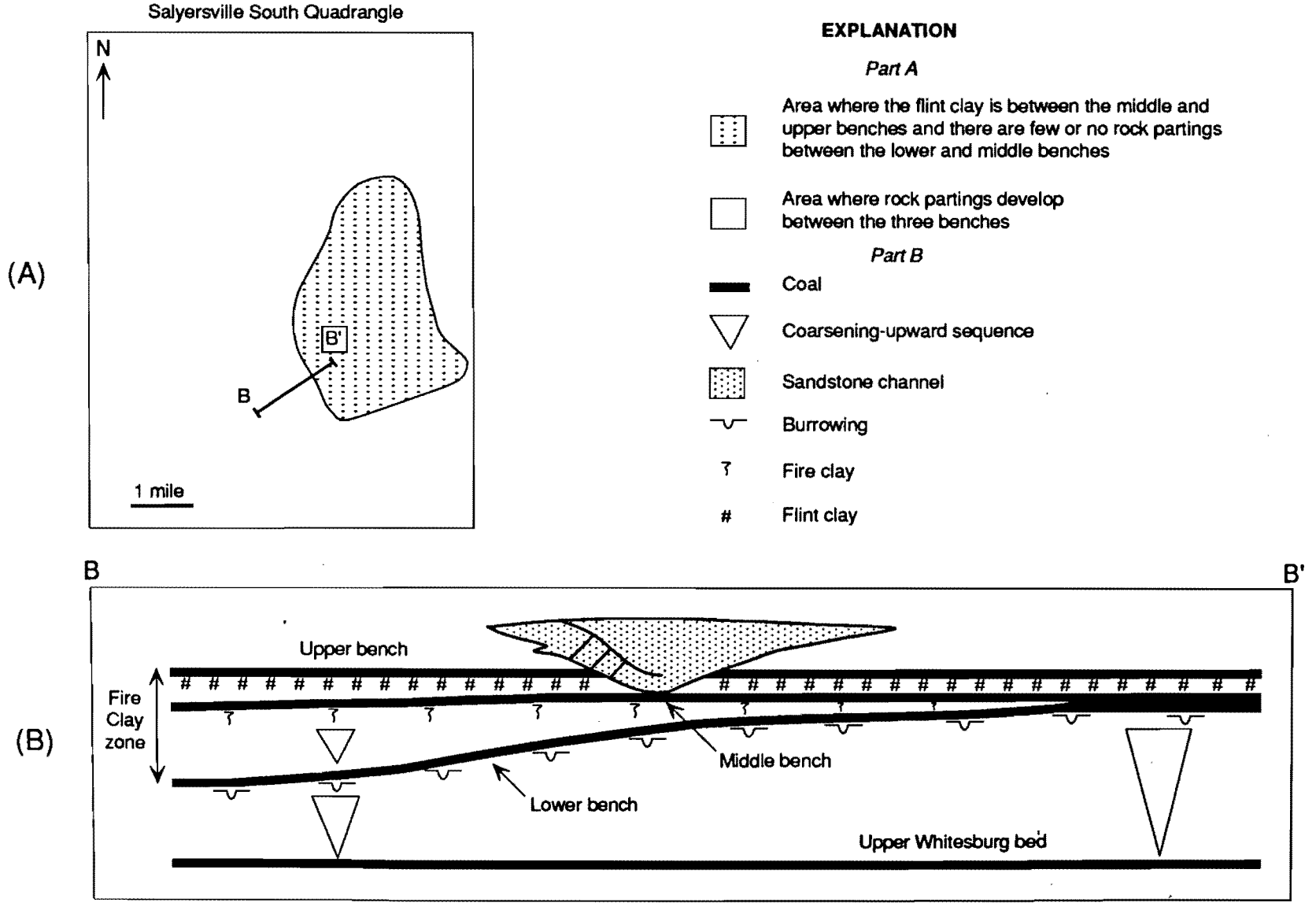
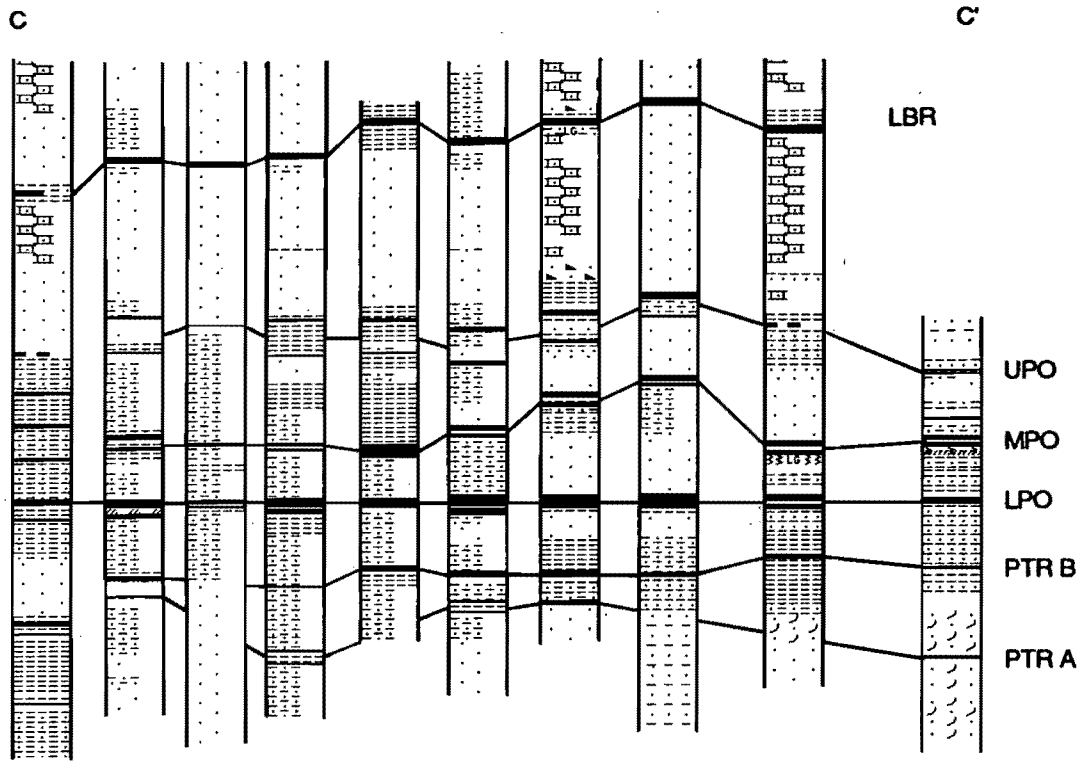
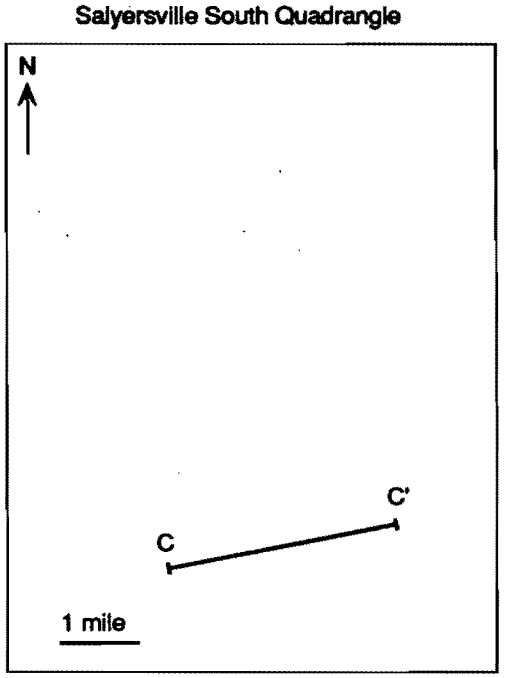


Figure 4. (A) Area in the Salyersville South Quadrangle where the three benches of the Fire Clay zone are separated by only thin rock partings. (B) Generalized cross section depicting the splitting of the three benches of the Fire Clay zone in the Salyersville South Quadrangle.





Vertical scale of cross section is 1" = 60'

EXPLANATION

- Common banded coal
- Impure coal
- Bone coal with coal streaks
- Dark-gray shale
- Light gray-green fire clay
- Dark-gray shale with sandstone streaks
- Dark-gray, massive, sandy shale
- Dark-gray, sandy fire clay
- Light gray-green, massive, sandy shale
- Gray, massive sandstone
- Gray, crossbedded sandstone
- Gray sandstone with shale streaks
- Gray, massive, carbonate-cemented sandstone
- Gray ironstone-pebble conglomerate
- Gray sandstone with coal spars

Figure 5. Geologic cross section of the Lower Broas to Prater A coal beds. The Lower Peach Orchard coal was the datum. Abbreviations for coal bed names are explained in Figure 2.

the Kentucky Natural Resources and Environmental Protection Cabinet and the Kentucky Department of Mines and Minerals. Land-use restrictions were digitized from U.S. Geological Survey (USGS) 7.5-minute topographic base maps. The locations of oil and gas wells were obtained from the Kentucky Geological Survey Geologic Data Center. Restrictions and mined-out areas were field checked for accuracy.

Restrictions to Mining

Most land-use restrictions are outlined under the Kentucky Natural Resources and Environmental Protection Cabinet Document 405 KAR (Kentucky Administrative Register) 24:040, entitled "Areas Unsuitable For Mining." This document relates to KRS (Kentucky Revised Statutes) 350.465 and 350.610, which define the regulatory program for surface mining in Kentucky. Land-use restrictions can apply to both surface- and deep-mineable coals, as shown in Table 1. For this study, land-use restrictions were applied only to coals potentially mineable by surface methods. Nine of the restriction categories apply to the Salyersville South Quadrangle. Except for Federally funded highways, Nationally protected lands, and cemeteries, variances are often granted for many of the listed restrictions.

Table 1.—Potential Restrictions with Applicable Buffer Zones and Overburden Categories to Which They Apply. Restrictions Found in Salyersville South Quadrangle and Applicable Mine Category Indicated by Asterisks.

RESTRICTIONS	BUFFER	MINE CATEGORY	
		SURFACE	DEEP
Land-Use			
Airports	area + 100'	X	X
Bridges	area + 100'	X	
Cemeteries	area + 100'	X *	
Faults	area + 100'	X *	X
Oil & Gas Wells	200 '	X *	
Public Lands	area	X	X
Pipelines	area + 100'	X *	
Powerlines	area + 100'	X *	
Railroads	area + 100'	X *	
Roads	area + 100'	X *	
Streams	area + 100'	X *	X
Parks, National	area	X	
Parks, State	area	X	
Municipalities	area + 300'	X *	X
Technological			
Coal Too Thin	area		X *
Coal Too Deep	area		X
Faults	area + 100'		X
Interburden < 40'	area		X *
Mine Barriers	50'		X *
Mining Within 40'	area		X
Oil & Gas Wells	200 '		X *

Technological restrictions for this study apply to potentially deep-mineable coals. They include barriers around existing underground mines, potential mining within 40 vertical feet of a seam, oil and gas wells, and coal too thin (less than 28 inches) for current underground mining methods (Table 1). Three of these restriction categories apply to the Salyersville South Quadrangle.

Data Analysis

The GIS software utilized for this phase of the project was GRASS (Geographical Resources Analysis Support System), a U.S. government software package developed primarily by the U.S. Army Corps of Engineers, the U.S. Soil Conservation Service, and the USGS. GRASS is a raster-based GIS, which means that map data are rendered as matrices of equal-sized grid cells. Maps stored in a GRASS data base must be oriented to a particular coordinate system. The UTM system, based on the Clark 1866 spheroid, was chosen for this study. In order to utilize map information for calculations, the original vector data (points, lines, or areas) must be converted to raster (gridded) data files. The size of grid cells (resolution) for each map must be specified, but can vary between maps. Table 2 lists the method of preparation and resolution for the maps utilized in this study.

In the case of thickness and elevation point data, a gridding algorithm was used to interpolate cell nodes between data points. Two algorithms were utilized. The first, "s.surf.pln," accepts unequally spaced data and applies a first-order trend surface fit to the nearest neighbors found by the specified search. This program works best on structural data, which have a large first-order component. It also works adequately on thickness data that are relatively closely spaced. Interpolation problems occur in areas of sparse data and in the vicinity of closely spaced points that differ substantially in thickness. The second algorithm, "s.surf.idw," uses a simple inverse-distance weighting function. This program is efficient at honoring data points, but is inaccurate farther away from the points. It was implemented for coal beds where few data were available and the area of outcrop was limited (uppermost beds). A summary of point data associated with each coal bed in this study is given in Table 3.

Once all maps were prepared, the USGS program RESOURCES used GRASS commands to calculate

Table 2.—Map Types Used for GRASS Data Analysis.

Map Type	*Data Source*	*Method of Generating GRASS Cell*	*Resolution*	*Comments*
Map Boundary	corner points		5 meters	used as data mask
Outcrops	1:24,000 USGS GQ	digitized	5 meters	used for original resource maps
Mines	Dept. of Mines & Minerals	digitized	5 meters	used for remaining resource calculations
Land-Use Restrictions	1:24,000 topographic map	digitized	5 meters	used for available resource calculations
Oil & Gas Wells	KGS Geologic Data Center	s. poly output	5 meters	restriction
Reliability Arcs	Derived from thickness locations	s. poly output	5 meters	reliability categories
Digital Elevation Model	1:24,000 USGS digital file		30 meters	used for creating overburden maps
Structure Contour	KCRIS & CMASTER	s.surf.pln	30 meters	used for overburden maps
Overburden Isopach	derived	r.mapcalc	10 meters	
Thickness Isopach	KCRIS & CMASTER	s.surf.pln or s.surf.idw	30 meters	used for thickness maps

Table 3.—Summary of Data Associated With Each Coal Bed Used in Resource Calculations.

Coal Bed	*Area (acres)*	*Percent of Area > 14"*	*Data Points*	*Surface-Mine Area*	*Deep-Mine Area*
Skyline A	466	100	12	287	—
Lower Broas	3,083	98	39	251	—
Upper Peach Orchard	6,891	55	65	2,205	—
Middle Peach Orchard	7,633	41	50	2,588	—
Lower Peach Orchard	8,341	86	65	2,951	—
Prater B	11,449	7	23	152	—
Prater A	11,449	17	20	152	—
Fire Clay	25,902	71	104	64	4
Gun Creek	33,448	44	104	—	—

areas (in square meters) for all resource categories (original, mined-out, remaining, restricted, and available). Using the following definitions, these data were then converted to acres, and tons were calculated:

1 acre — 4,047 square meters

1 acre/foot of bituminous coal — 1,800 short tons

Resource Categories

Tonnage estimates for each bed are reported by categories of coal thickness, overburden thickness, and reliability of the estimate. Standard USGS procedures (Wood and others, 1983) stipulate thickness categories in multiples of 14 inches up to 42 inches, and multiples of 42 inches up to 168 inches. Categories above 168 inches are aggregated. For the Coal Availability studies in eastern Kentucky, only two categories are used: 14-to-28-inches and greater-than-28-inches. This division is based on the constraint that coal less than 28 inches thick is generally not mineable by underground methods.

Overburden categories are also based on the potential effect on mining method. Three categories are defined: surface-mineable, deep-mineable, and too deep to mine with current technology. The footages for these categories can vary depending on topographic relief and seam and interburden thicknesses, but are generally 100 or 200 feet for maximum surface mine depths, and 1,000 feet for maximum underground overburden.

It is common in eastern Kentucky underground mines for overburden to exceed 1,000 feet under the crests of ridges. Because these areas are generally small, this condition usually is not considered a restriction to underground mining. For this study 100 feet of overburden was used was an upper limit for surface mining and 100 to 1,000 feet of overburden was the range for underground mining. No overburden thicknesses were found to exceed the upper limit for underground mining. In practice, however, maximum overburden height for surface mining is generally determined by a ratio of overburden to coal thickness. The fixed footage used in these studies only provides an estimate of surface-mineable and deep-mineable areas.

Reliability categories are based on distance from coal-thickness measurements. "Measured" resources lie within 1/4 mile (1,320 feet or 402 meters) of a data point, "indicated" resources between 1/4 and 3/4 mile (3,960 feet or 1,207 meters), "inferred" resources between 3/4 and 3 miles (15,840 feet or 4,828 meters), and "hypothetical" resources beyond 3 miles. It is generally accepted that the rate of thickness variation differs for most coal beds; hence, "reliability" can only be interpreted in this context. However, the reliability categories do provide an indication of data spacing.

RESULTS

Overview

Original, mined-out, remaining, restricted, and available coal resources were calculated for nine coal beds in the Salyersville South Quadrangle. In ascending stratigraphic order, these beds are the Gun Creek, Fire Clay, Prater A, Prater B, Lower Peach Orchard, Middle Peach Orchard, Upper Peach Orchard, Lower Broas, and Skyline A (Fig. 2). All the beds crop out within the quadrangle, and most are accessible by surface and underground mining methods. Resource, mining, and restriction estimates are summarized in tables for each bed by categories of coal thickness (14-to-28-inches or greater-than-28-inches) and overburden thickness (0-to-100-feet or 100-to-1,000-feet). Appendix A details completely the results of this study for each bed by coal thickness, overburden, and reliability.

The results of this Coal Availability investigation, grouped by thickness and overburden categories, for each coal bed in the Salyersville South Quadrangle, are shown as percentages of the total in Figures 6 and 7. Tonnages are summarized in Table 4, which lists the original, remaining, and available resources for each bed and totals for mined-out and restricted coal. Results of this study indicate that 80.5 million tons (44 percent) of the original resources (183.4 million tons) are available for future economic development. A total of 23.4 million tons (13 percent) of the original resources have been mined out by surface and underground methods. A total of 79.4 million tons (43 percent) of the remaining resources are restricted from future mining. Technological restrictions (mainly coal too thin to mine by current underground methods) account for 82 percent of the combined restrictions.

Restrictions to mining not included in this study include surface and mineral ownership divisions not conducive to mineral development, economic considerations (recoverability), and undocumented geologic problems such as channel cutouts, seam splitting, or poor coal quality. In the near future the U.S. Bureau of Mines will investigate the recoverability of coal in the Salyersville South Quadrangle.

Original Resources

Original coal resources represent estimates of the total amount of coal greater than 14 inches in thickness prior to any mining. The 14-inch limit is arbitrary, but very little coal less than this thickness has been mined. The total original resources for all beds in this study are estimated as 183.4 million tons. The distribution of original coal resources aggregated by thickness and overburden categories is given in Table 5 and illustrated in Figures 6 through 9. The previous estimate for the same beds (Brant and others, 1983) was 169.3 million tons, a difference of only 8 percent. However, on a bed-by-bed basis the differences varied from 6 to 208 percent. Compared to the present study, the Skyline A, Lower Broas, and Gun Creek beds were underestimated by Brant and others (1983) and the Prater B and Middle Peach Orchard were overestimated, each by more than 50 percent. These differences in resource estimates occurred because the previous study used fewer thickness data points. Brant and others (1983) also estimated an additional 69 million tons for other beds in the quadrangle. However, these estimates were based on few data or data located outside the map area. The present data set did not confirm the presence of mineable coal for these other beds. Consequently, they were not included in this study.

Distribution of Original Resources

Stratigraphic Position

The relative stratigraphic position of each coal bed along with the total outcrop area of each bed and the proportion of the outcrop areas containing coal greater than 14 inches thick are shown in Figure 8. The total tonnage, given in Table 5, indicates that the resources are

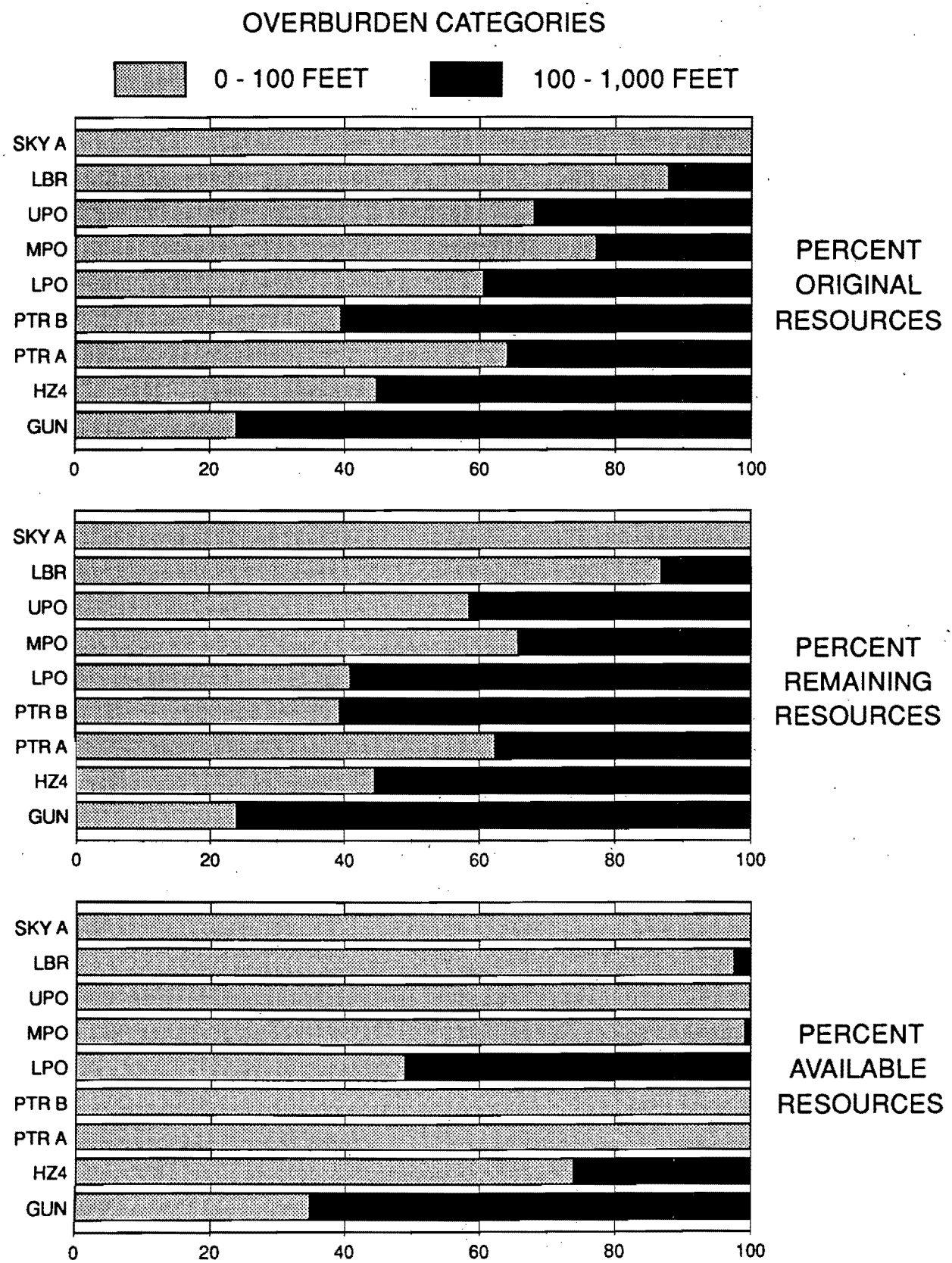


Figure 6. Percentages of original, remaining, and available coal resources in the 0-to-100-feet and 100-to-1,000-feet overburden categories. Abbreviations are explained in Figure 2.

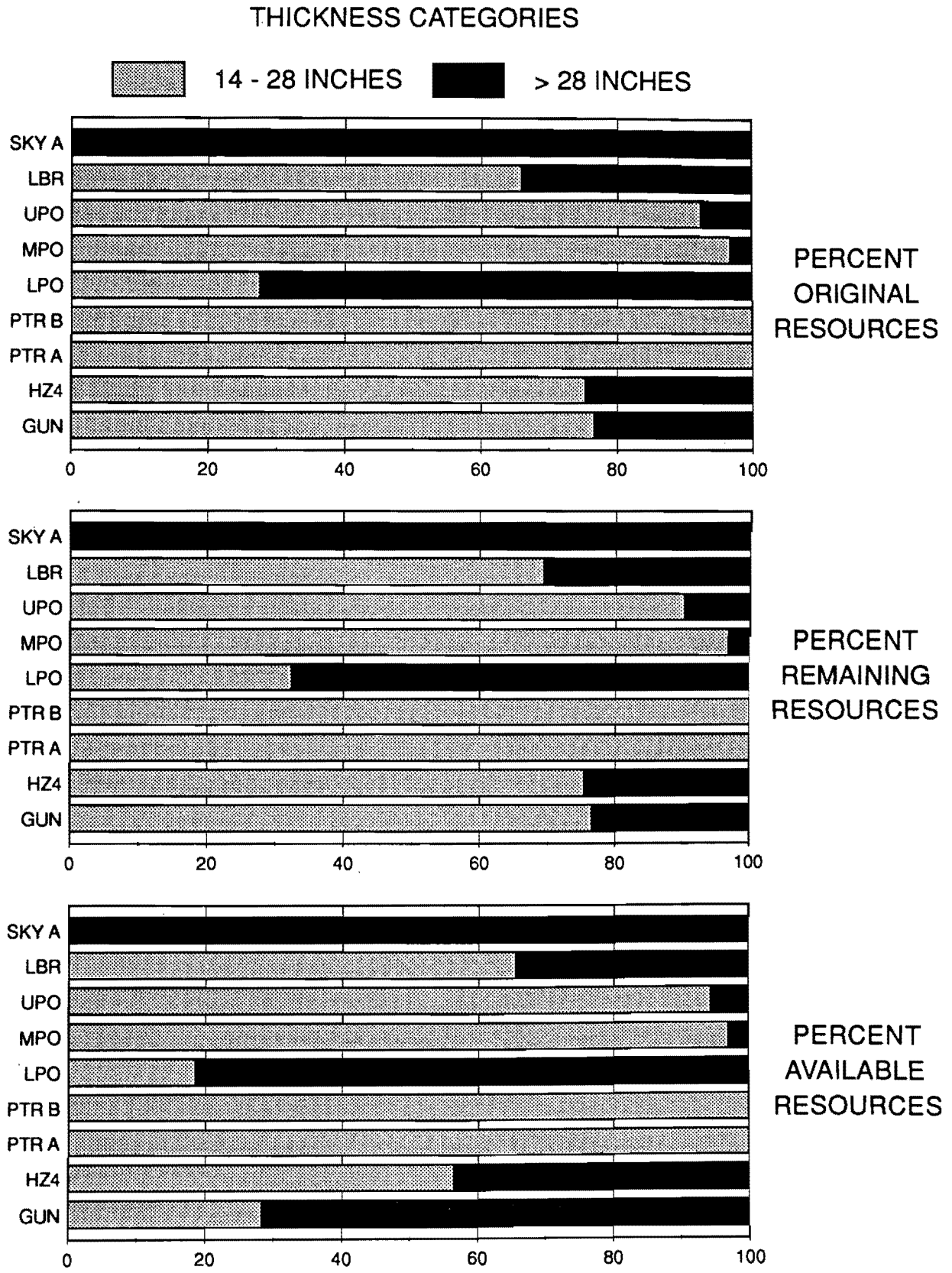


Figure 7. Percentages of original, remaining, and available coal resources in the 14-to-28-inches and greater-than-28-inches thickness categories. Abbreviations are explained in Figure 2.

Table 4.—Summary of Total Tonnage Estimates for Original, Mined-Out, Remaining, Restricted, and Available Coal Resources (Thousands of Short Tons).

Coal Bed	Original	Mined-Out	Remaining	Restrictions		Available
				Land-Use	Technological	
Skyline A	2,803	1,639	1,165	0	0	1,165
Lower Broas	11,005	1,013	9,992	48	1,105	8,839
Upper Peach Orchard	10,756	2,674	8,081	42	3,347	4,692
Middle Peach Orchard	9,171	3,570	5,600	44	1,888	3,669
Lower Peach Orchard	33,678	14,069	19,608	204	3,426	15,978
Prater B	1,881	5	1,876	39	1,138	699
Prater A	5,160	241	4,919	60	1,850	3,008
Fire Clay	62,212	276	61,936	6,308	26,867	28,761
Gun Creek	46,776	0	46,776	6,439	26,565	13,773
TOTAL	183,442	23,488	159,954	13,184	66,186	80,584

Table 5.—Original Coal Resources Reported by Overburden and Thickness Categories (Thousands of Short Tons).[1]

Coal Bed	0-100'			100-1,000'			Thickness Totals		TOTALS
	14-28"	> 28"	Total	14-28"	> 28"	Total	14-28"	> 28"	
Skyline A	2	2,801	2,803	0	0	0	2	2,801	2,803
Lower Broas	6,133	3,530	9,663	1,114	227	1,342	7,248	3,757	11,005
Upper Peach Orchard	7,021	302	7,323	2,909	523	3,432	9,930	825	10,756
Middle Peach Orchard	6,896	188	7,084	1,979	107	2,086	8,875	295	9,171
Lower Peach Orchard	5,574	14,832	20,405	3,690	9,583	13,272	9,263	24,415	33,678
Prater B	743	0	743	1,138	0	1,138	1,881	0	1,881
Prater A	3,309	0	3,309	1,851	0	1,851	5,160	0	5,160
Fire Clay	20,316	7,501	27,816	26,458	7,937	34,396	46,774	15,438	62,212
Gun Creek	9,340	1,881	11,221	26,456	9,099	35,555	35,796	10,980	46,776
TOTAL	59,336	31,035	90,370	65,595	27,477	93,072	124,931	58,512	183,442

1 Totals may not equal sum of components because of independent rounding.

not distributed uniformly with respect to stratigraphic position. The Gun Creek and Fire Clay contain 59 percent of the original resources; Prater A to Lower Broas, 39 percent; and Skyline A, 2 percent. This upward decrease in resources is a direct function of the diminished area of outcrop for topographically higher beds. Figure 8 shows that the rate of decrease in outcrop area is greater for the lower coal beds than for the upper beds. This relationship is similar to that found for the Booneville Quadrangle (Weisenfluh and others, 1992) and the inverse of the results of the Handshoe Quadrangle study (Weisenfluh and others, 1993).

Overburden Categories

The distribution of coal resources on the basis of overburden categories is illustrated in Figures 6 and 9 and listed in Table 5. The 100-to-1,000-feet category comprises 51 percent of the total estimate. The amount of coal in the 0-to-100-feet overburden category increases, as expected, from topographically lower to higher beds, while the amount of coal in the 100-to-1,000-feet overburden category decreases (Figs. 6 and 9). Figure 10 represents the stripping potential or outcrop access for each bed as measured by the total length of the outcrop perimeter. In eastern Kentucky, mining potential is, in part, a function of outcrop access, because few shaft or slope mines have been developed. Figure 10 shows that the coal beds between and including the Fire Clay and Upper Peach Orchard have the greatest potential outcrop access and therefore the greatest strip-mining potential.

Thickness Categories

The distribution of coal resources on the basis of thickness categories is given in Table 5 and illustrated in Figure 7. In addition, Appendix A contains maps showing the areal distribution of thickness categories for each bed. The coal beds in this quadrangle are dominantly in the 14-to-28-inch category (68 percent). As shown in Figure 7, only two beds have more than 50 percent of their original resources in the greater-than-28-inch category. These two beds, Skyline A and

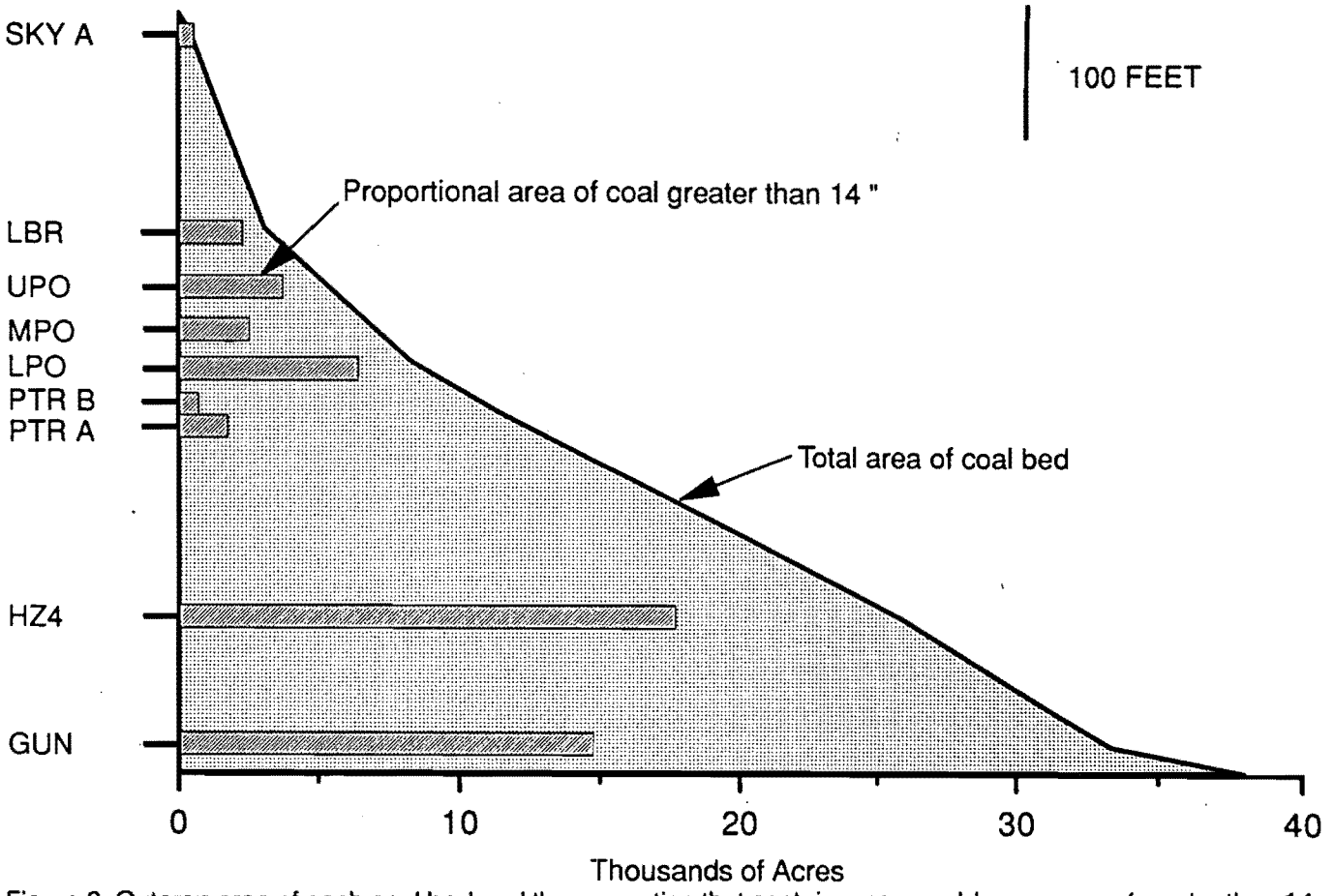


Figure 8. Outcrop area of each coal bed and the proportion that contains measurable resources (greater than 14 inches thick). Abbreviations are explained in Figure 2.

Lower Peach Orchard, make up 47 percent of the greater-than-28-inch resources.

Geographic Distribution

The geographic arrangement of coal resources is illustrated by maps in Appendix A, which show the thickness distribution and outcrop area of each bed. One of the factors that favors extensive surface mining is the geographic coincidence of thick, stratigraphically successive coal beds, particularly for the topographically highest beds. Figure 11 shows areas where the Lower Peach Orchard and Lower Broas coal beds both are greater that 28 inches thick. In areas where the thickest parts of both coals coincide, both beds have been mined together by contour and mountaintop-removal methods.

Reliability of the Estimates

The reliability estimates are tabulated for each bed in Appendix A and illustrated in Figure 12. The data density for this study is quantified in Table 3, in which the total acreage and number of points per bed are given. For all beds, approximately 19 percent of the resource was estimated as measured, 44 percent as indicated, 36 percent as inferred, and 1 percent as hypothetical.

Mined-Out and Remaining Resources

Estimates of mined-out tonnages and remaining resources are aggregated by thickness and overburden categories in Tables 6 through 8. In this study, mined-out tonnages were estimated from mine acreages and extrapolated coal thicknesses that were interpolated from discrete thickness measurements. Production data were not used because associating these data with specific map areas was difficult and they do not account for coal lost in mining.

The total amount of coal mined in the Salyersville South Quadrangle as of 1992 was 23.5 million tons, 13 percent of the original estimate. Almost all of this amount has been mined by surface methods, and most of the surface tonnage has come from the Lower Peach Orchard coal bed. No mining has occurred in the Gun Creek coal bed. Although the Fire Clay bed was shown to have the greatest mining access (Fig. 10) and a relatively large proportion of coal greater then 28 inches

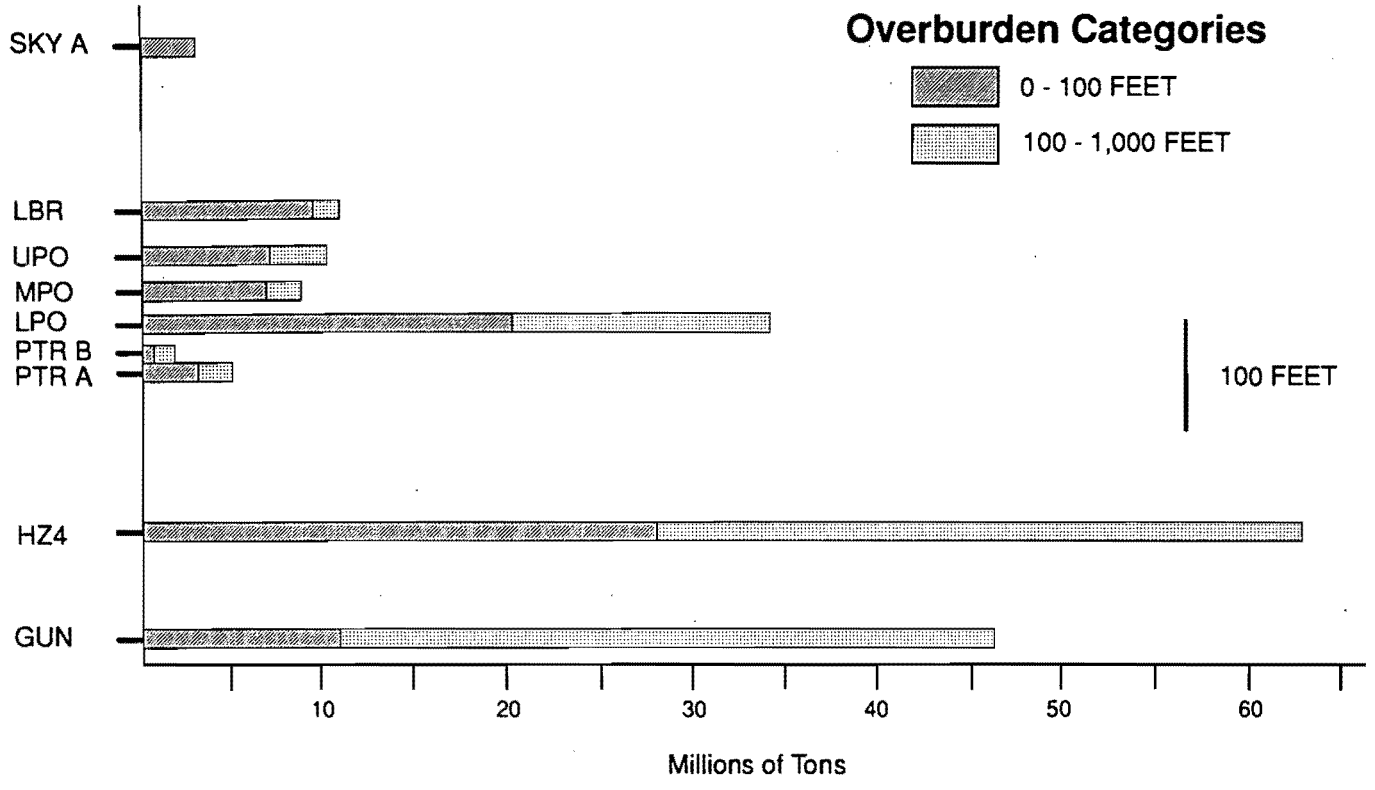


Figure 9. Stratigraphic distribution of original resources differentiated by overburden category. Abbreviations are explained in Figure 2.

thick, little mining has taken place in this seam, possibly because of a large number of partings or other quality parameters.

Total remaining resources are estimated at 160 million tons or 87 percent of the original. These resources are, for most beds, distributed similarly to the original estimates with respect to thickness and overburden categories (Figs. 6–7). About 72 percent of the resources are in the 14-to-28-inch thickness category and 57 percent are in the 100-to-1,000-feet overburden category. Three beds, the Lower Peach Orchard, Fire Clay, and Gun Creek, make up 80 percent of the remaining resources.

Restrictions and Available Resources

Tonnages for restricted coal are reported in two formats. In order to calculate the available resources, the unique area of each restriction is subtracted from remaining resources. This method is necessary because of overlapping buffers for some restrictions. In many areas, for example, roads, streams, and municipal areas occupy the same general space in valley bottoms. These results (total restriction tonnages by overburden and thickness categories) are shown in Table 9. Table 10 and Appendix A give the total tonnages associated with each restriction and its buffer without accounting for overlap. Appendix B contains maps showing where the restrictions are located within the quadrangle. In most cases the sum of these restriction tonnages will exceed the totals used for calculating available resources.

The total amount of coal restricted in the Salyersville South Quadrangle is 79.4 million tons, or 50 percent of the remaining resource. Technological restrictions (largely coal too thin to mine by underground methods) account for 82 percent of this total. Only 13 million tons are associated with land-use restrictions, and most of the coal is restricted by municipal areas and oil and gas wells. The northwestern part of the quadrangle contains an oil field where wells are so closely spaced that any form of mining is impractical.

The amount of coal available for mining in the Salyersville South Quadrangle is 80.6 million tons (Table 11), which represents 44 percent of original and 50 percent of remaining resources. An estimated 55.7 million tons (69 percent) of available coal resources are in the less-than-100-feet overburden category and there is an equal distribution of the available resources between thickness categories. The Lower Peach Orchard, Fire Clay, and Gun Creek account for 73 percent of the avail-

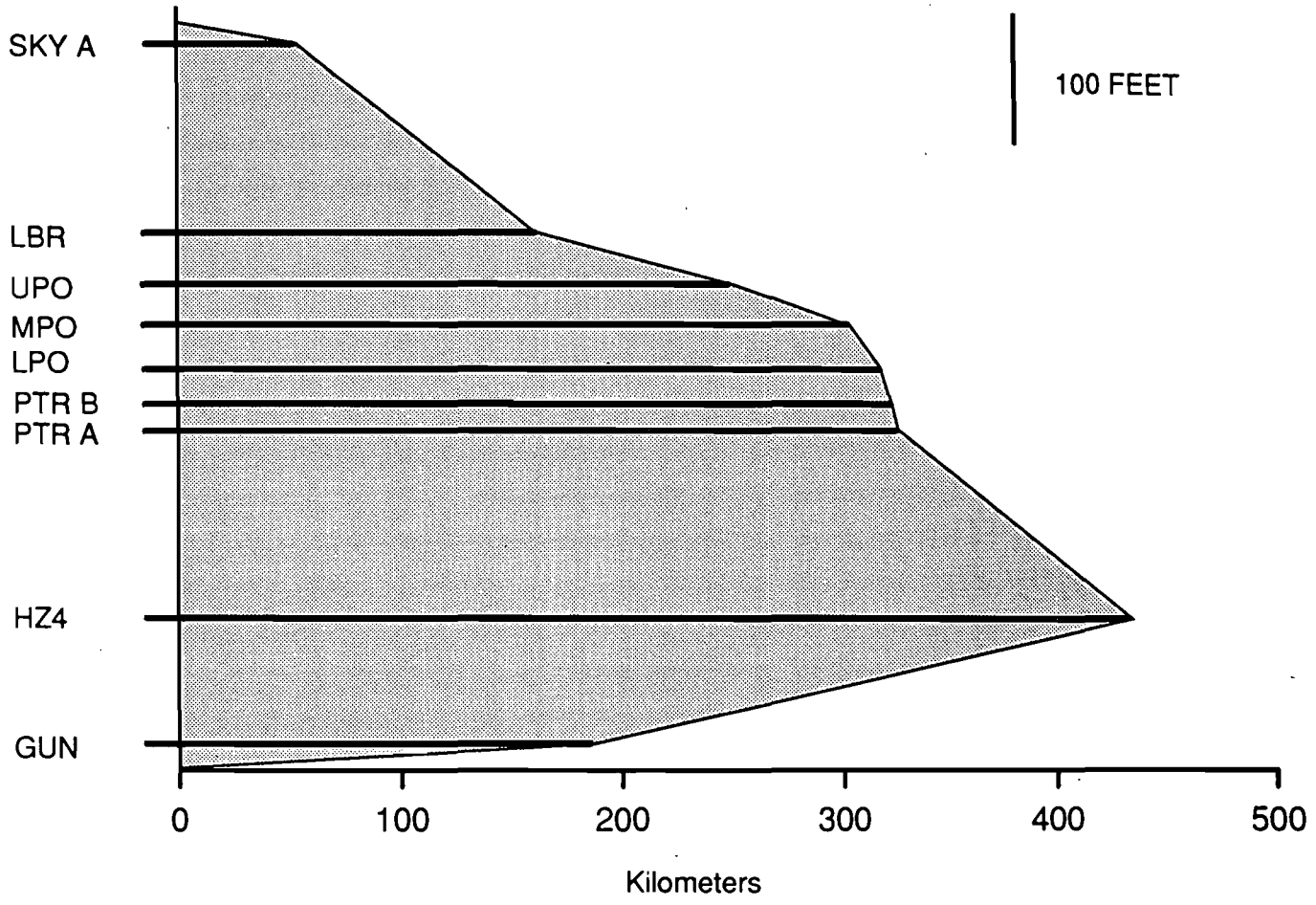


Figure 10. Total linear distance of outcrop for coal beds in the Salyersville South Quadrangle. Abbreviations are explained in Figure 2.

able resources, and most of this amount is in the less-than-100-feet overburden category.

COMPARISON TO PREVIOUS STUDIES

A summary of the 10 Eastern Kentucky Coal Availability Study quadrangles is presented in Table 12. The Salyersville South Quadrangle has the second smallest amount of original resources compared to the nine previously studied quadrangles. Historically, the amount of coal in the Licking River Coal Reserve District is less than in other districts in eastern Kentucky. The Booneville (Weisenfluh and others, 1992), Noble (Sergeant and others, 1988), and Matewan (Carter and Gardner, 1989) Quadrangles have a similar percentage of mining, compared to this quadrangle. The proportional amount of land-use restrictions in this quadrangle is similar to that in the Hoskinston (Davidson and others, 1991) and Boltsfork (Anderson and others, 1991) Quadrangles, and the proportional amount of technological restrictions in this quadrangle is similar to that in the Booneville (Weisenfluh and others, 1992) and Middlesboro North (Kentucky Geological Survey, 1990) Quadrangles. The percentage of coal available for future mining in this quadrangle is similar to the percentage available in the Middlesboro North (Kentucky Geological Survey, 1990) and Hoskinston (Davidson and others, 1991) Quadrangles.

ACKNOWLEDGMENTS

The authors wish to acknowledge several organizations that have contributed to this investigation. A project of this scope and nature cannot be completed without the diligent effort of many workers. Personnel from the Kentucky Department of Mines and Minerals provided access to and assistance with data from the Underground Mine Map Repository. The Kentucky Natural Resources and Environmental Protection Cabinet supplied surface-mine maps and lands-unsuitable-for-mining maps.

The Petroleum and Stratigraphy Section of the Kentucky Geological Survey provided a location map of producing oil and gas wells. The Publications Section

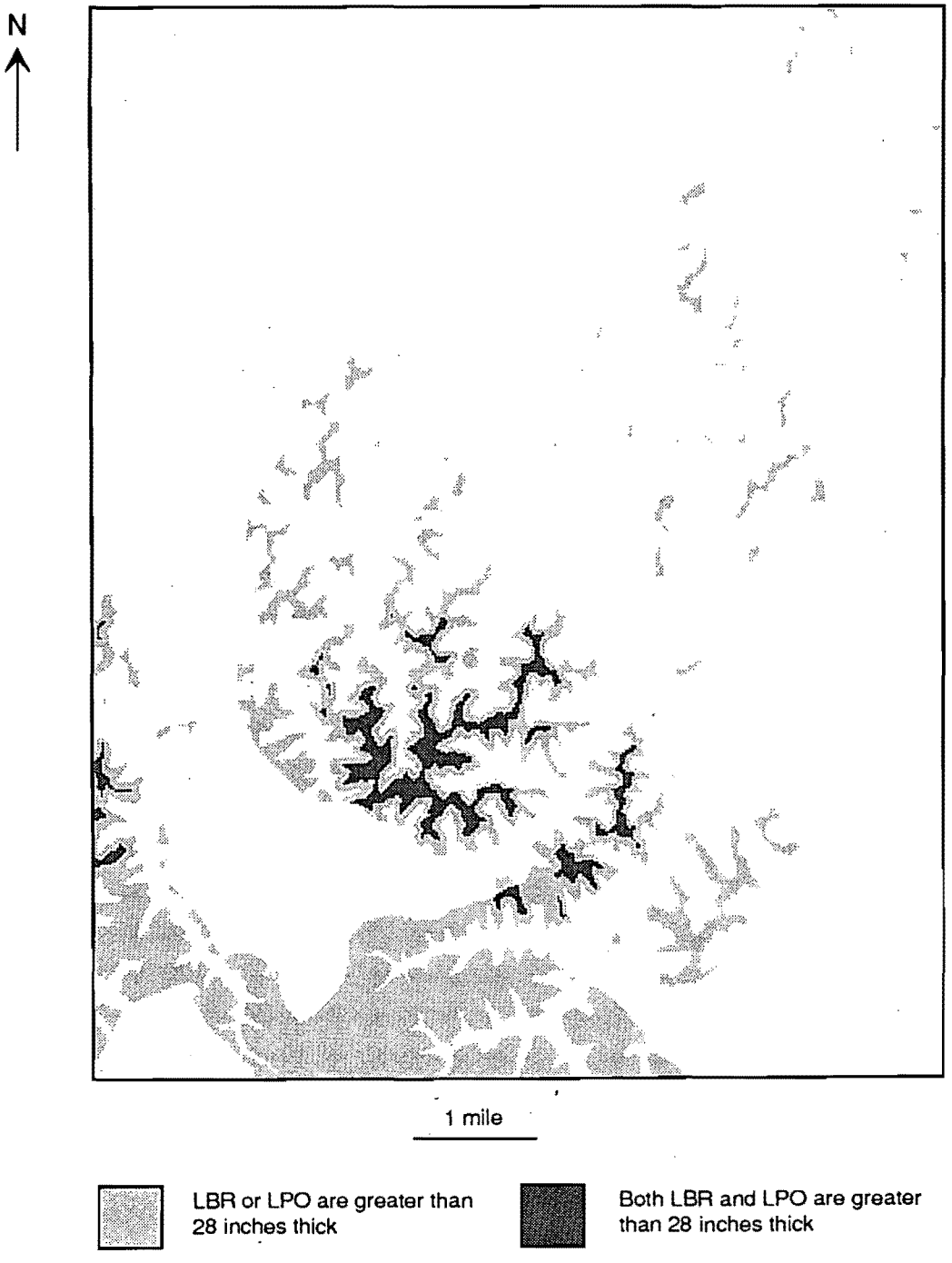


Figure 11. Areas where the Lower Broas and Lower Peach Orchard coal beds are greater than 28 inches in thickness.

of the Kentucky Geological Survey assisted in preparation of the final report.

Donald Chesnut, Stephen Greb, Cortland Eble, and James Cobb reviewed earlier versions of the manuscript.

REFERENCES CITED

Anderson, W.H., Davidson, O.B., Chesnut, D.R., Jr., Sergeant, R.E., Cecil, Jude, and Hiett, J.K., 1991, Final report of the Boltsfork Quadrangle coal availability

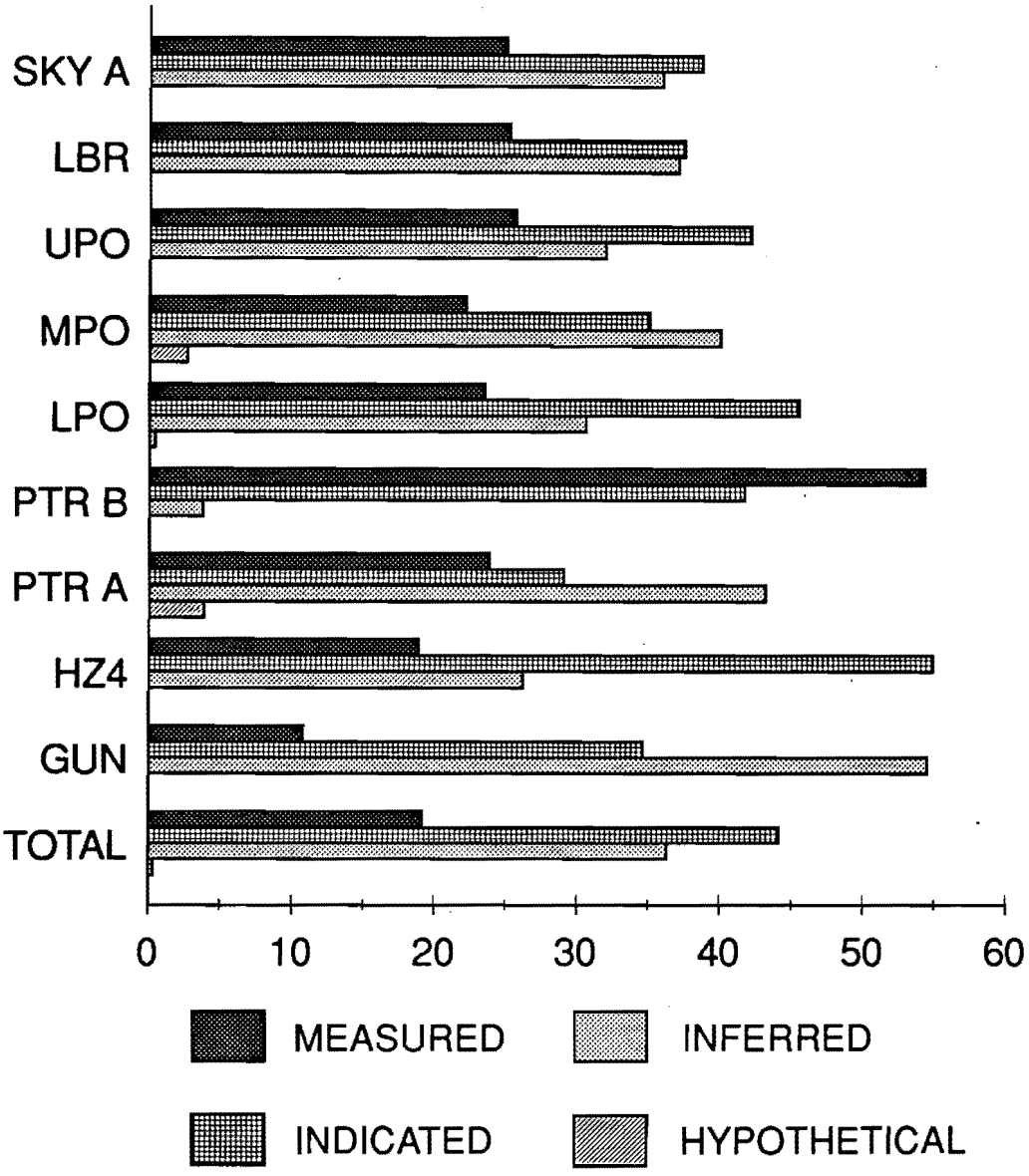


Figure 12. Proportion of original resources in each reliability category for the Salyersville South Quadrangle. Abbreviations are explained in Figure 2.

study: Kentucky Geological Survey, U.S. Department of the Interior Grant 14-08–0001–A0564, 30 p.

Brant, R.A., Chesnut, D.R., Frankie, W.T., and Portig, E.R., 1983, Coal resources of the Princess District, Kentucky: University of Kentucky Institute for Mining and Minerals Research, Energy Resource Series, 49 p.

Carter, M.D., and Gardner, N.K., 1989, An assessment of coal resources available for development: Central Appalachian region, first year summary: U.S. Geological Survey Open-File Report 89-362, 52 p.

Davidson, O.B., Anderson, W.H., Chesnut, D.R., Jr., Sergeant, R.E., Smath, R.A., and Hiett, J.K., 1991, Final report of the Hoskinston Quadrangle coal availability study: Kentucky Geological Survey, U.S. Department of the Interior Grant 14-08-0001-A0564, 37 p.

Eggleston, J.R., Carter, M.D., and Cobb, J.C., 1990, Coal resources available for development—A methodology and pilot study: U.S. Geological Survey Circular 1055, 15 p.

Kentucky Geological Survey, 1990, Final report of the Middlesboro North Quadrangle coal availability study: Kentucky Geological Survey, U.S. Department of the Interior Grant 14-08-0001-A0564, 50 p.

Table 6.—Coal Resources Mined Out by Surface Methods, Reported by Overburden and Thickness Categories (Thousands of Short Tons).[1]

Coal Bed	0-100'			100-1,000'			Thickness Totals		TOTALS
	14-28"	> 28"	Total	14-28"	> 28"	Total	14-28"	> 28"	
Skyline A	2	1,636	1,639	0	0	0	2	1,636	1,639
Lower Broas	306	687	994	10	10	20	316	697	1,013
Upper Peach Orchard	2,558	34	2,592	82	*	83	2,640	34	2,674
Middle Peach Orchard	3,293	108	3,402	164	5	169	3,458	113	3,570
Lower Peach Orchard	2,602	9,775	12,377	314	1,378	1,692	2,916	11,154	14,069
Prater B	5	0	5	0	0	0	5	0	5
Prater A	241	0	241	*	0	*	241	0	241
Fire Clay	116	139	255	0	0	0	116	139	255
Gun Creek	0	0	0	0	0	0	0	0	0
TOTAL	9,123	12,380	21,503	570	1,393	1,963	9,693	13,773	23,467

[1] Totals may not equal sum of components because of independent rounding.
* Indicates measurements less than the reported precision.

Table 7.—Coal Resources Mined Out by Underground Methods, Reported by Overburden and Thickness Categories (Thousands of Short Tons).[1]

Coal Bed	0-100'			100-1,000'			Thickness Totals		TOTALS
	14-28"	> 28"	Total	14-28"	> 28"	Total	14-28"	> 28"	
Skyline A	0	0	0	0	0	0	0	0	0
Lower Broas	0	0	0	0	0	0	0	0	0
Upper Peach Orchard	0	0	0	0	0	0	0	0	0
Middle Peach Orchard	0	0	0	0	0	0	0	0	0
Lower Peach Orchard	0	0	0	0	0	0	0	0	0
Prater B	0	0	0	0	0	0	0	0	0
Prater A	0	0	0	0	0	0	0	0	0
Fire Clay	0	13	13	0	8	8	0	22	22
Gun Creek	0	0	0	0	0	0	0	0	0
TOTAL	0	13	13	0	8	8	0	22	22

[1] Totals may not equal sum of components because of independent rounding.

Table 8.—Remaining Coal Resources Reported by Overburden and Thickness Categories (Thousands of Short Tons).[1]

Coal Bed	0-100'			100-1,000'			Thickness Totals		TOTALS
	14-28"	> 28"	Total	14-28"	> 28"	Total	14-28"	> 28"	
Skyline A	0	1,165	1,165	0	0	0	0	1,165	1,165
Lower Broas	5,827	2,843	8,670	1,105	217	1,322	6,932	3,060	9,992
Upper Peach Orchard	4,464	268	4,732	2,827	523	3,350	7,290	791	8,081
Middle Peach Orchard	3,603	80	3,682	1,815	103	1,918	5,418	182	5,600
Lower Peach Orchard	2,972	5,056	8,028	3,375	8,204	11,580	6,348	13,261	19,608
Prater B	738	0	738	1,138	0	1,138	1,876	0	1,876
Prater A	3,069	0	3,069	1,850	0	1,850	4,919	0	4,919
Fire Clay	20,200	7,349	27,549	26,458	7,929	34,387	46,658	15,277	61,936
Gun Creek	9,340	1,881	11,221	26,456	9,099	35,555	35,796	10,980	46,776
TOTAL	50,213	18,641	68,854	65,025	26,075	91,100	115,237	44,717	159,954

[1] Totals may not equal sum of components because of independent rounding.

Table 9.—Total Restrictions Reported by Overburden and Thickness Categories (Thousands of Short Tons).[1]

Coal Bed	0-100'			100-1,000'			Thickness Totals		TOTALS
	14-28"	> 28"	Total	14-28"	> 28"	Total	14-28"	> 28"	
Skyline A	0	0	0	0	0	0	0	0	0
Lower Broas	48	0	48	1,105	0	1,105	1,153	0	1,153
Upper Peach Orchard	34	8	42	2,827	520	3,347	2,861	528	3,389
Middle Peach Orchard	44	0	44	1,815	73	1,888	1,858	73	1,931
Lower Peach Orchard	23	181	204	3,375	51	3,426	3,398	232	3,630
Prater B	39	0	39	1,138	0	1,138	1,177	0	1,177
Prater A	60	0	60	1,850	0	1,850	1,911	0	1,911
Fire Clay	3,976	2,331	6,308	26,458	408	26,867	30,435	2,740	33,175
Gun Creek	5,447	992	6,439	26,456	109	26,565	31,903	1,101	33,004
TOTAL	9,671	3,513	13,184	65,025	1,161	66,186	74,696	4,674	79,370

[1] Totals may not equal sum of components because of independent rounding.

Table 10.—Total Tonnages Associated with Individual Restriction Categories. Does Not Account for Overlapping Areas (Thousands of Short Tons).

Coal Bed	Land Use									Technological			
	Cemeteries	Faults	Oil & Gas	Pipelines	Powerlines	Railroads	Roads	Streams	Municipal Areas	Barriers	Interburden < 40'	Oil & Gas	Coal Too Thin
Skyline A	0	0	0	0	0	0	0	0	0	0	0	0	0
Lower Broas	0	0	48	0	0	0	0	0	1	0	0	11	1,105
Upper Peach Orchard	0	0	22	*	0	0	0	8	12	0	520	53	2,827
Middle Peach Orchard	0	0	27	6	9	0	0	*	2	0	73	0	1,815
Lower Peach Orchard	0	0	104	12	42	0	*	21	24	0	0	98	3,375
Prater B	0	0	1	0	0	0	0	16	22	0	0	14	1,138
Prater A	0	0	0	0	16	0	0	0	44	0	0	0	1,850
Fire Clay	22	19	2,191	97	287	14	301	306	3,616	4	0	520	26,458
Gun Creek	79	58	1,796	45	97	207	662	652	4,766	0	0	1,851	26,456

* Indicates measurements less than the reported precision.

Table 11.—Available Coal Resources Reported by Overburden and Thickness Categories (Thousands of Short Tons.)[1]

Coal Bed	0-100'			100-1,000'			Thickness Totals		TOTALS
	14-28"	> 28"	Total	14-28"	> 28"	Total	14-28"	> 28"	
Skyline A	0	1,165	1,165	0	0	0	0	1,165	1,165
Lower Broas	5,779	2,843	8,622	0	217	217	5,779	3,060	8,839
Upper Peach Orchard	4,430	260	4,690	0	3	3	4,430	263	4,692
Middle Peach Orchard	3,559	80	3,639	0	30	30	3,559	110	3,669
Lower Peach Orchard	2,949	4,875	7,824	0	8,154	8,154	2,949	13,029	15,978
Prater B	699	0	699	0	0	0	699	0	699
Prater A	3,008	0	3,008	0	0	0	3,008	0	3,008
Fire Clay	16,224	5,017	21,241	0	7,520	7,520	16,224	12,538	28,761
Gun Creek	3,894	889	4,783	0	8,990	8,990	3,894	9,879	13,773
TOTAL	40,542	15,128	55,670	0	24,914	24,914	40,542	40,043	80,584

[1] Totals may not equal sum of components because of independent rounding.

Sergeant, R.E., Cobb, J.C., Davidson, O.B., Anderson, W.H., Stickney, J.F., Chesnut, D.R., Jr., Smath, R.A., Hiett, J.K., Perry, D.B., and Gauthier, M.A., 1988, Final report of the Noble Quadrangle coal availability study: Kentucky Geological Survey, U.S. Department of the Interior Grant 14-08-0001-A0564, 43 p.

Sergeant, R.E., Cobb, J.C., Davidson, O.B., Smath, R.A., Stickney, J.F., Chesnut, D.R., Jr., Anderson, W.H., Hiett, J.K., and Perry, D.B., 1989, Final report of the Millard Quadrangle coal availability study: Kentucky Geological Survey, U.S. Department of the Interior Grant 14-08-0001-A0564, 48 p.

Sites, R.S., and Hostettler, K.K., 1991, Available coal resources study of the Appalachia 7.5-minute quadrangle, Virginia–Kentucky: Virginia Division of Mineral Resources, Publication 118, 51 p.

Spengler, R.W., 1977, Geologic map of the Salyersville South Quadrangle, eastern Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1373.

Weisenfluh, G.A., Andrews, R.E., Hiett, J.K., Greb, S.F., Sergeant, R.E., and Chesnut, D.R., Jr., 1992, Available coal resources of the Booneville 7.5-minute quadrangle, Owsley County, Kentucky: Kentucky Geological Survey, ser. 11, Information Circular 42, 26 p.

Weisenfluh, G.A., Andrews, R.E., Hiett, J.K., and Sergeant, R.E., 1993, Available coal resources of the Handshoe 7.5-minute quadrangle, Knott County, Kentucky: Kentucky Geological Survey, ser. 11, Information Circular 43, 45 p.

Wood, G.H., Jr., Kehn, T.M., Carter, M.D., and Culbertson, W.C., 1983, Coal resource classification system of the United States Geological Survey: U.S. Geological Survey Circular 891, 65 p.

Table 12.—Summary of 10 Eastern Kentucky Coal Availability Quadrangles Giving Total Tonnages (Millions of Short Tons) and Proportions.*

Quadrangle	*Original Resources*		*Remaining Resources*[1]		*Land-Use Restrictions*[2]		*Technological Restrictions*[2]		*Available Resources*[1]	
Appalachia[3]	1,349	100%	1,005	75%	26	3%	277	28%	703	52%
Boltsfork[4]†	243	100%	231	95%	15	7%	43	19%	173	71%
Booneville[5]	80	100%	70	88%	1	1%	29	41%	40	50%
Handshoe[6]	645	100%	633	98%	10	2%	220	35%	403	63%
Hoskinston[7]†	342	100%	332	98%	19	6%	171	52%	142	42%
Matewan[8]	987	100%	858	87%	17	2%	226	26%	616	62%
Middlesboro North[9]	339	100%	328	97%	36	11%	138	42%	155	46%
Millard[10]†	843	100%	777	92%	30	4%	400	52%	347	41%
Noble[11]†	460	100%	399	86%	58	15%	71	18%	270	59%
Salyersville South	183	100%	160	87%	13	8%	66	41%	81	44%

* All tonnages and percentages rounded to nearest whole number.
† Results updated in 1993.
1 Percentage of original.
2 Percentage of remaining.
3 Sites and Hostettler (1991).
4 Anderson and others (1991).
5 Weisenfluh and others (1992).
6 Weisenfluh and others (1993).
7 Davidson and others (1991).
8 Carter and Gardner (1989).
9 Kentucky Geological Survey (1990).
10 Sergeant and others (1989).
11 Sergeant and others (1988).

APPENDIX A:
Coal Availability Results, Area of Outcrop, and Total Coal Thickness

FIRE CLAY COAL BED
Coal Availability Results
(Thousands of Short Tons)[1]

	0–100′								*100–1,000′*							
	14–28″				*> 28″*				*14–28″*				*> 28″*			
	MEAS	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*
Original	3,258	9,736	7,323	0	2,567	4,007	927	0	3,231	15,734	7,493	0	2,671	4,711	555	0
Mined-Out Surface	17	15	83	0	75	62	2	0	0	0	0	0	0	0	0	0
Mined-Out Deep	0	0	0	0	13	0	0	0	0	0	0	0	8	0	0	0
Remaining	3,241	9,720	7,239	0	2,478	3,945	925	0	3,231	15,734	7,493	0	2,663	4,711	555	0
Total Restrictions	869	1,888	1,220	0	803	1,271	257	0	3,231	15,734	7,493	0	16	375	17	0
Total Available	2,372	7,832	6,020	0	1,675	2,674	668	0	0	0	0	0	2,647	4,336	538	0
Land-Use Restrictions[2]																
Cemeteries	6	15	0	0	*	*	0	0	0	0	0	0	0	0	0	0
Faults	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	113	236	606	0	104	922	210	0	0	0	0	0	0	0	0	0
Pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Powerlines	33	61	55	0	48	89	0	0	0	0	0	0	0	0	0	0
Railroads	12	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Roads	76	103	31	0	88	3	0	0	0	0	0	0	0	0	0	0
Streams	40	198	37	0	26	*	5	0	0	0	0	0	0	0	0	0
Towns	681	1,463	508	0	647	286	31	0	0	0	0	0	0	0	0	0
Technological Restrictions[2]																
Deep-Mine Barriers	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Interburden < 40′	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	0	0	0	0	0	0	0	28	55	32	0	12	375	17	0
Coal Too Thin	0	0	0	0	0	0	0	0	3,231	15,734	7,493	0	0	0	0	0

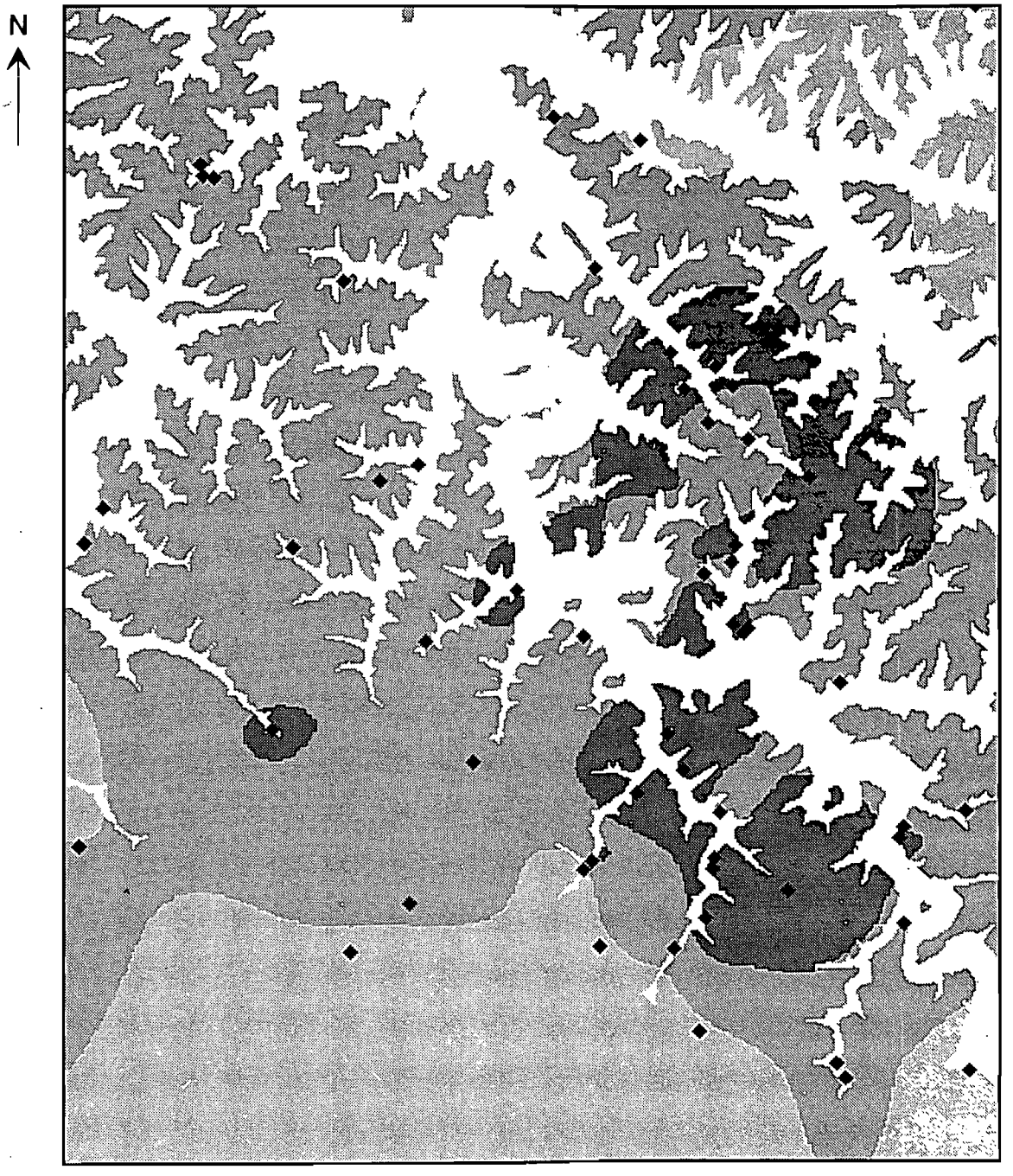
MEAS=Measured. IND=Indicated. INF=Inferred. HYP=Hypothetical.

*Indicates measurements less than reported precision.

[1]Totals may not equal sum of components because of independent rounding.

[2]Total tonnage associated with each category. Sums of individual restrictions exceed the restriction total due to overlapping areas.

Fire Clay Coal Bed



GUN CREEK COAL BED
Coal Availability Results
(Thousands of Short Tons)[1]

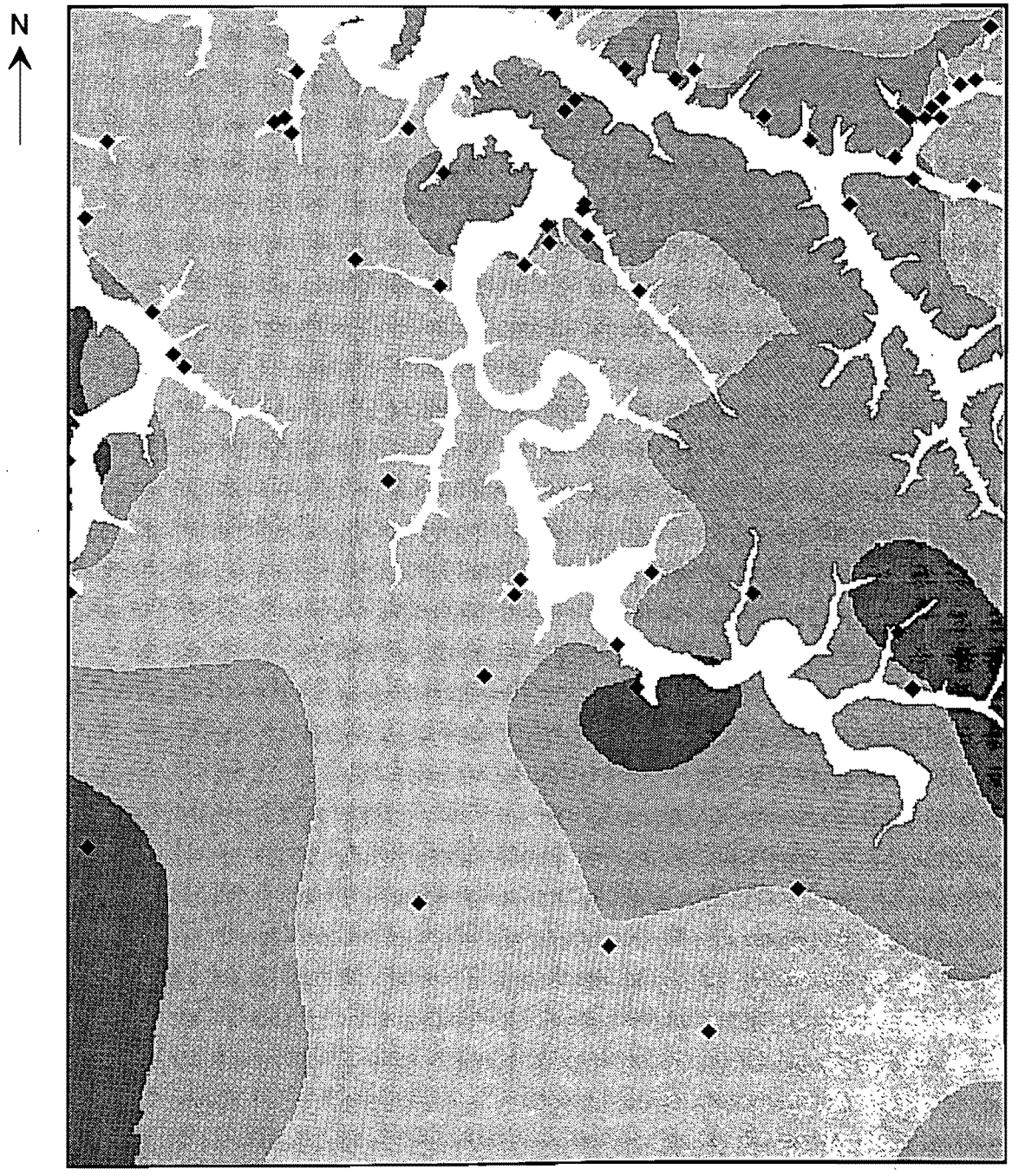
	0–100′								*100–1,000′*							
	14–28″				*> 28″*				*14–28″*				*> 28″*			
	MEAS	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*
Original	1,710	3,390	4,240	0	519	1,251	112	0	1,741	7,286	17,429	0	1,089	4,268	3,742	0
Mined-Out Surface	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mined-Out Deep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Remaining	1,710	3,390	4,240	0	519	1,251	112	0	1,741	7,286	17,429	0	1,089	4,268	3,742	0
Total Restrictions	975	1,766	2,706	0	303	628	61	0	1,741	7,286	17,429	0	10	99	0	0
Total Available	735	1,624	1,534	0	216	622	51	0	0	0	0	0	1,079	4,169	3,742	0
Land-Use Restrictions[2]																
Cemeteries	13	36	19	0	0	11	0	0	0	0	0	0	0	0	0	0
Faults	35	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	119	180	1,304	0	44	127	23	0	0	0	0	0	0	0	0	0
Pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Powerlines	24	51	22	0	0	0	0	0	0	0	0	0	0	0	0	0
Railroads	2	33	61	0	24	85	1	0	0	0	0	0	0	0	0	0
Roads	85	166	288	0	30	90	3	0	0	0	0	0	0	0	0	0
Streams	8	65	401	0	34	136	8	0	0	0	0	0	0	0	0	0
Towns	834	1,579	1,464	0	277	552	59	0	0	0	0	0	0	0	0	0
Technological Restrictions[2]																
Deep-Mine Barriers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interburden < 40′	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	0	0	0	0	0	0	0	69	155	1,518	0	10	99	0	0
Coal Too Thin	0	0	0	0	0	0	0	0	1,741	7,286	17,429	0	0	0	0	0

MEAS=Measured. IND=Indicated. INF=Inferred. HYP=Hypothetical.

[1]Totals may not equal sum of components because of independent rounding.

[2]Total tonnage associated with each category. Sums of individual restrictions exceed the restriction total due to overlapping areas.

Gun Creek Coal Bed

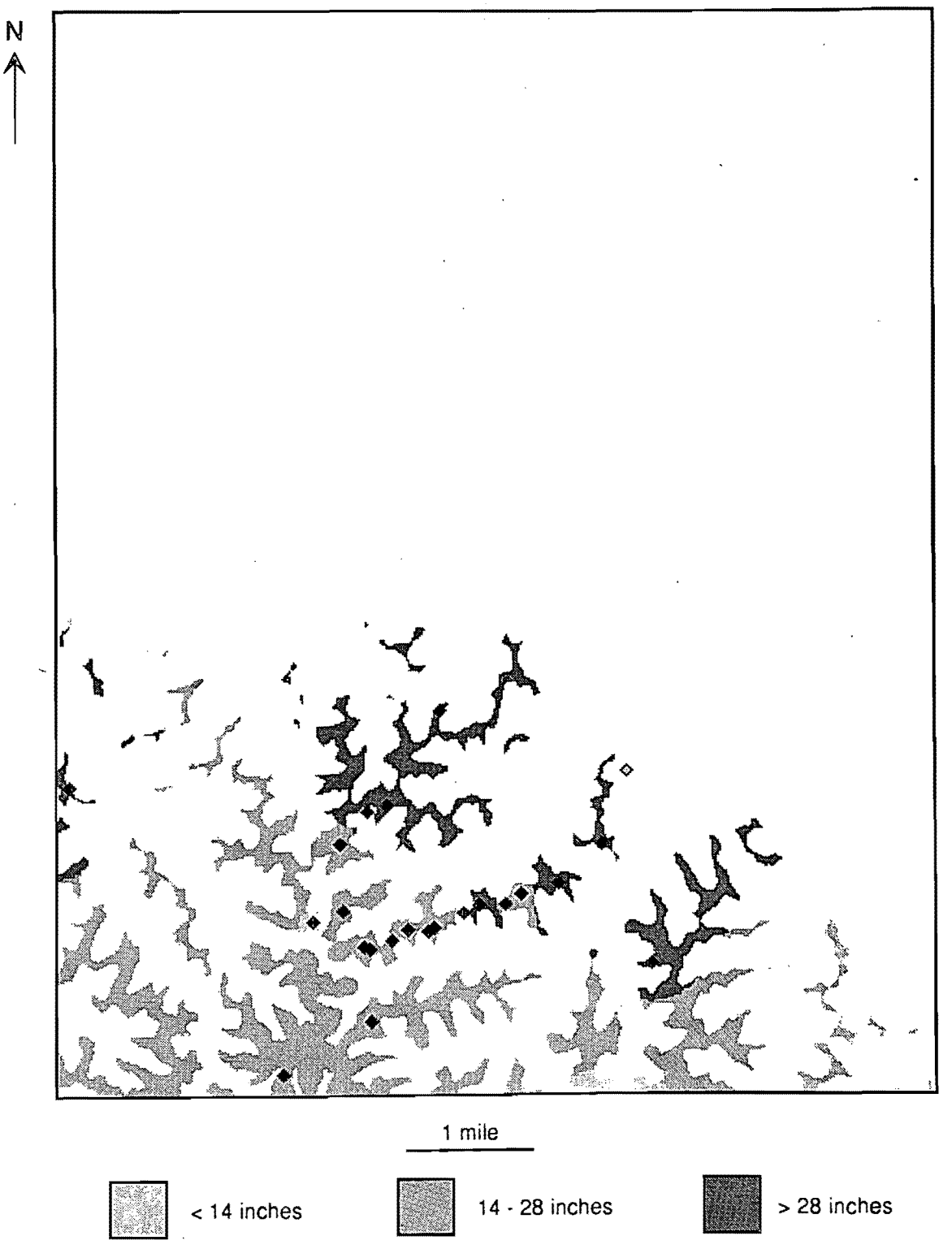


LOWER BROAS COAL BED
Coal Availability Results
(Thousands of Short Tons)[1]

	0–100′								100–1,000′							
	14–28″				> 28″				14–28″				> 28″			
	MEAS	IND	INF	HYP	MEAS	IND	INF	HYP	MEAS	IND	INF	HYP	MEAS	IND	INF	HYP
Original	1,083	2,136	2,915	0	1,197	1,527	806	0	359	404	351	0	137	70	20	0
Mined-Out Surface	173	104	30	0	248	218	221	0	6	1	3	0	0	6	4	0
Mined-Out Deep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Remaining	910	2,032	2,885	0	950	1,309	584	0	353	403	348	0	137	65	15	0
Total Restrictions	10	12	27	0	0	0	0	0	353	403	348	0	0	0	0	0
Total Available	900	2,020	2,858	0	950	1,309	584	0	0	0	0	0	137	65	15	0
Land-Use Restrictions[2]																
Cemeteries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faults	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	10	11	26	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Powerlines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Railroads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Streams	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Towns	0	*	*	0	0	0	0	0	0	0	0	0	0	0	0	0
Technological Restrictions[2]																
Deep-Mine Barriers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interburden < 40′	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	0	0	0	0	0	0	0	2	5	4	0	0	0	0	0
Coal Too Thin	0	0	0	0	0	0	0	0	353	403	348	0	0	0	0	0

MEAS=Measured. IND=Indicated. INF=Inferred. HYP=Hypothetical.
*Indicates measurements less than reported precision.
[1]Totals may not equal sum of components because of independent rounding.
[2]Total tonnage associated with each category. Sums of individual restrictions exceed the restriction total due to overlapping areas.

Lower Broas Coal Bed



Diamonds indicate location of data points

LOWER PEACH ORCHARD COAL BED
Coal Availability Results
(Thousands of Short Tons)[1]

	0–100′								*100–1,000′*							
	14–28″				*> 28″*				*14–28″*				*> 28″*			
	MEAS	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*
Original	1,068	2,708	1,699	99	3,588	6,104	5,092	48	759	1,833	1,097	0	2,457	4,712	2,413	0
Mined-Out Surface	664	1,595	342	0	2,556	4,173	3,047	0	67	217	30	0	384	616	378	0
Mined-Out Deep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Remaining	404	1,113	1,356	99	1,033	1,931	2,045	48	692	1,616	1,067	0	2,073	4,096	2,035	0
Total Restrictions	0	6	16	1	3	82	96	0	692	1,616	1,067	0	15	32	4	0
Total Available	404	1,107	1,340	98	1,029	1,850	1,949	48	0	0	0	0	2,058	4,064	2,031	0
Land-Use Restrictions[2]																
Cemeteries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faults	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	*	5	0	0	34	64	0	0	0	0	0	0	0	0	0
Pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Powerlines	0	1	0	1	0	19	21	0	0	0	0	0	0	0	0	0
Railroads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads	0	0	0	0	0	0	*	0	0	0	0	0	0	0	0	0
Streams	0	1	0	0	0	11	9	0	0	0	0	0	0	0	0	0
Towns	0	3	*	0	3	17	*	0	0	0	0	0	0	0	0	0
Technological Restrictions[2]																
Deep-Mine Barriers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interburden < 40′	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	0	0	0	0	0	0	0	0	0	47	0	15	32	4	0
Coal Too Thin	0	0	0	0	0	0	0	0	692	1,616	1,067	0	0	0	0	0

MEAS=Measured. IND=Indicated. INF=Inferred. HYP=Hypothetical.

*Indicates measurements less than reported precision.

[1]Totals may not equal sum of components because of independent rounding.

[2]Total tonnage associated with each category. Sums of individual restrictions exceed the restriction total due to overlapping areas.

Lower Peach Orchard Coal Bed

Diamonds indicate location of data points

MIDDLE PEACH ORCHARD COAL BED
Coal Availability Results
(Thousands of Short Tons)[1]

	0–100′								*100–1,000′*							
	14–28″				*> 28″*				*14–28″*				*> 28″*			
	MEAS	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*
Original	1,255	2,427	2,969	245	188	0	0	0	482	790	708	0	107	0	0	0
Mined-Out Surface	860	1,436	997	0	108	0	0	0	58	78	28	0	5	0	0	0
Mined-Out Deep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Remaining	395	991	1,972	245	80	0	0	0	424	712	679	0	103	0	0	0
Total Restrictions	0	5	15	24	0	0	0	0	424	712	679	0	73	0	0	0
Total Available	395	986	1,957	221	80	0	0	0	0	0	0	0	30	0	0	0
Land-Use Restrictions[2]																
Cemeteries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faults	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	3	0	23	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Powerlines	0	0	9	*	0	0	0	0	0	0	0	0	0	0	0	0
Railroads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Streams	0	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Towns	0	2	*	0	0	0	0	0	0	0	0	0	0	0	0	0
Technological Restrictions[2]																
Deep-Mine Barriers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interburden < 40′	0	0	0	0	0	0	0	0	0	0	0	0	73	0	0	0
Oil & Gas Wells	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Too Thin	0	0	0	0	0	0	0	0	424	712	679	0	0	0	0	0

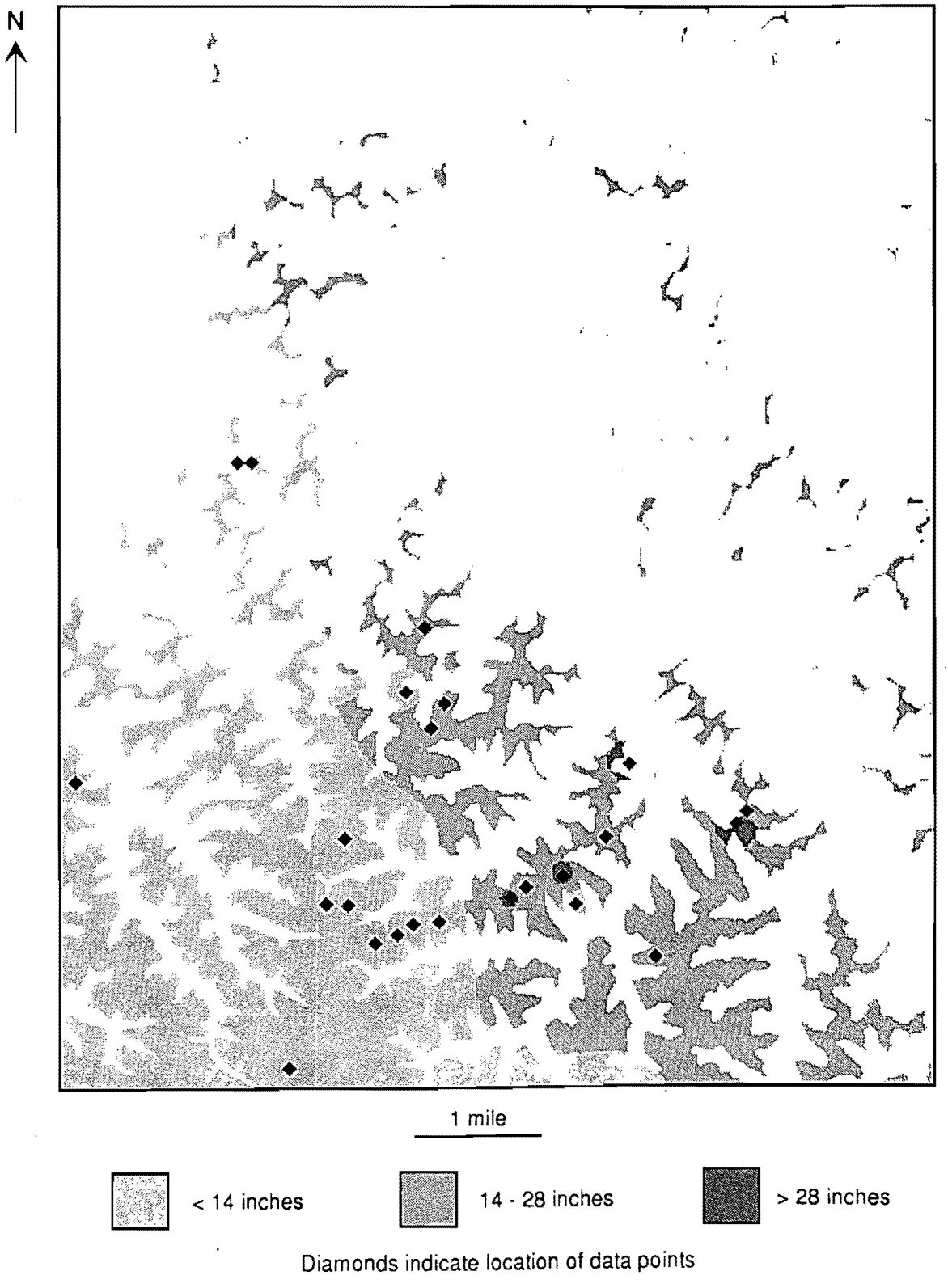
MEAS=Measured. IND=Indicated. INF=Inferred. HYP=Hypothetical.

*Indicates measurements less than reported precision.

[1]Totals may not equal sum of components because of independent rounding.

[2]Total tonnage associated with each category. Sums of individual restrictions exceed the restriction total due to overlapping areas.

Middle Peach Orchard Coal Bed



UPPER PEACH ORCHARD COAL BED
Coal Availability Results
(Thousands of Short Tons)[1]

	0–100′								100–1,000′							
	14–28″				> 28″				14–28″				> 28″			
	MEAS	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*
Original	1,563	2,943	2,510	6	236	66	0	0	513	1,466	930	0	450	74	0	0
Mined-Out Surface	778	1,246	534	0	34	0	0	0	22	51	10	0	0	*	0	0
Mined-Out Deep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Remaining	785	1,696	1,976	6	202	66	0	0	491	1,415	920	0	450	73	0	0
Total Restrictions	0	23	11	0	*	8	0	0	491	1,415	920	0	450	71	0	0
Total Available	785	1,674	1,965	6	202	58	0	0	0	0	0	0	0	3	0	0
Land-Use Restrictions[2]																
Cemeteries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faults	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	11	11	0	*	0	0	0	0	0	0	0	0	0	0	0
Pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Powerlines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Railroads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Streams	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0
Towns	0	12	*	0	0	0	0	0	0	0	0	0	0	0	0	0
Technological Restrictions[2]																
Deep-Mine Barriers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interburden < 40′	0	0	0	0	0	0	0	0	0	0	0	0	450	71	0	0
Oil & Gas Wells	0	0	0	0	0	0	0	0	0	3	32	0	19	0	0	0
Coal Too Thin	0	0	0	0	0	0	0	0	491	1,415	920	0	0	0	0	0

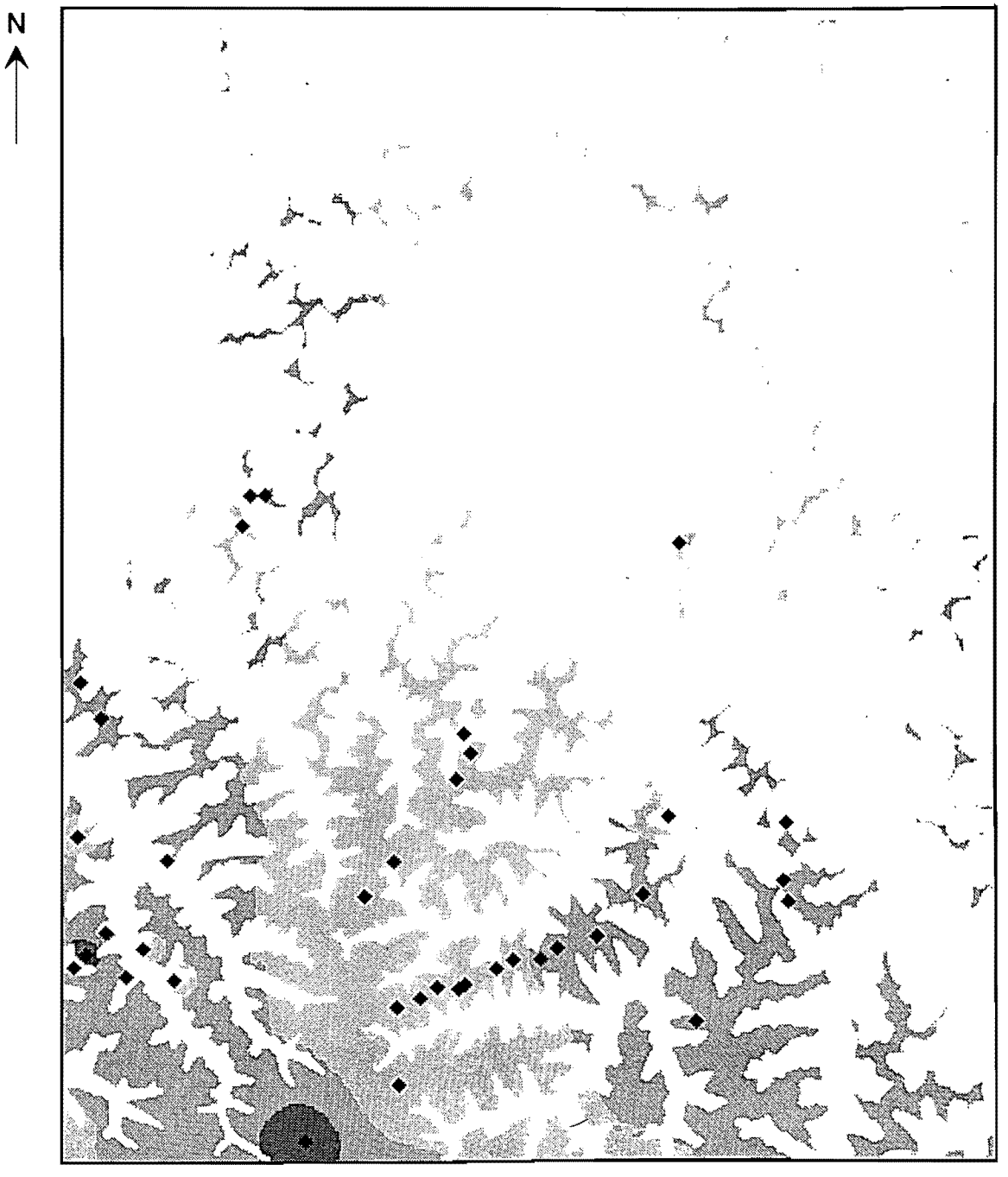
MEAS=Measured. IND=Indicated. INF=Inferred. HYP=Hypothetical.

*Indicates measurements less than reported precision.

[1]Totals may not equal sum of components because of independent rounding.

[2]Total tonnage associated with each category. Sums of individual restrictions exceed the restriction total due to overlapping areas.

Upper Peach Orchard Coal Bed



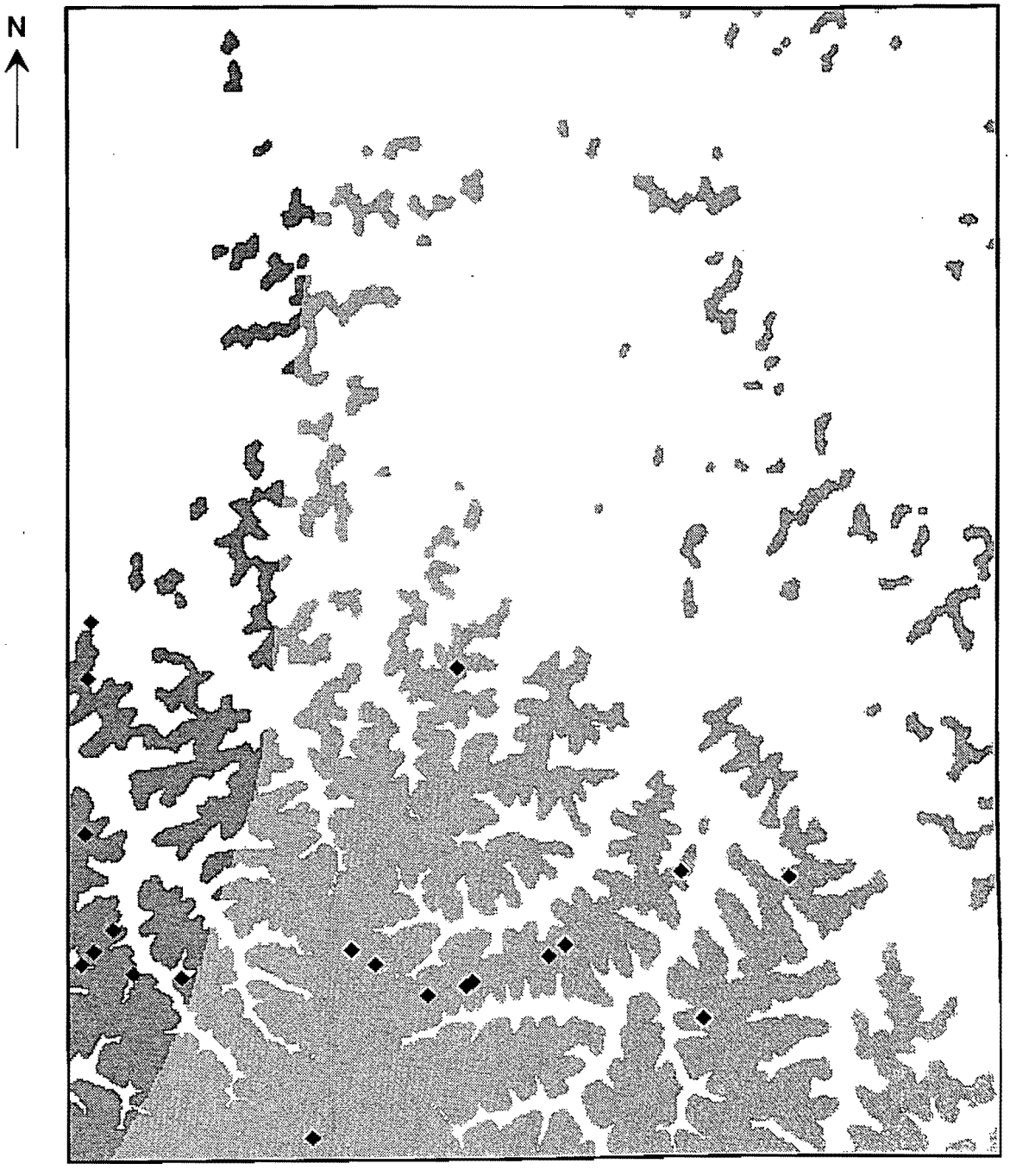
Diamonds indicate location of data points

PRATER A COAL BED
Coal Availability Results
(Thousands of Short Tons)[1]

	0–100′								100–1,000′							
	14–28″				> 28″				14–28″				> 28″			
	MEAS	IND	INF	HYP	MEAS	IND	INF	HYP	MEAS	IND	INF	HYP	MEAS	IND	INF	HYP
Original	667	829	1,619	194	0	0	0	0	563	672	611	5	0	0	0	0
Mined-Out Surface	113	28	99	0	0	0	0	0	*	0	0	0	0	0	0	0
Mined-Out Deep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Remaining	554	801	1,520	194	0	0	0	0	563	672	611	5	0	0	0	0
Total Restrictions	28	9	23	0	0	0	0	0	563	672	611	5	0	0	0	0
Total Available	526	792	1,497	194	0	0	0	0	0	0	0	0	0	0	0	0
Land-Use Restrictions[2]																
Cemeteries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faults	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Powerlines	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0
Railroads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Streams	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Towns	28	9	8	0	0	0	0	0	0	0	0	0	0	0	0	0
Technological Restrictions[2]																
Deep-Mine Barriers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interburden < 40′	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Too Thin	0	0	0	0	0	0	0	0	563	672	611	5	0	0	0	0

MEAS=Measured. IND=Indicated. INF=Inferred. HYP=Hypothetical.
*Indicates measurements less than reported precision.
[1]Totals may not equal sum of components because of independent rounding.
[2]Total tonnage associated with each category. Sums of individual restrictions exceed the restriction total due to overlapping areas.

Prater A Coal Bed



Diamonds indicate location of data points

PRATER B COAL BED
Coal Availability Results
(Thousands of Short Tons)[1]

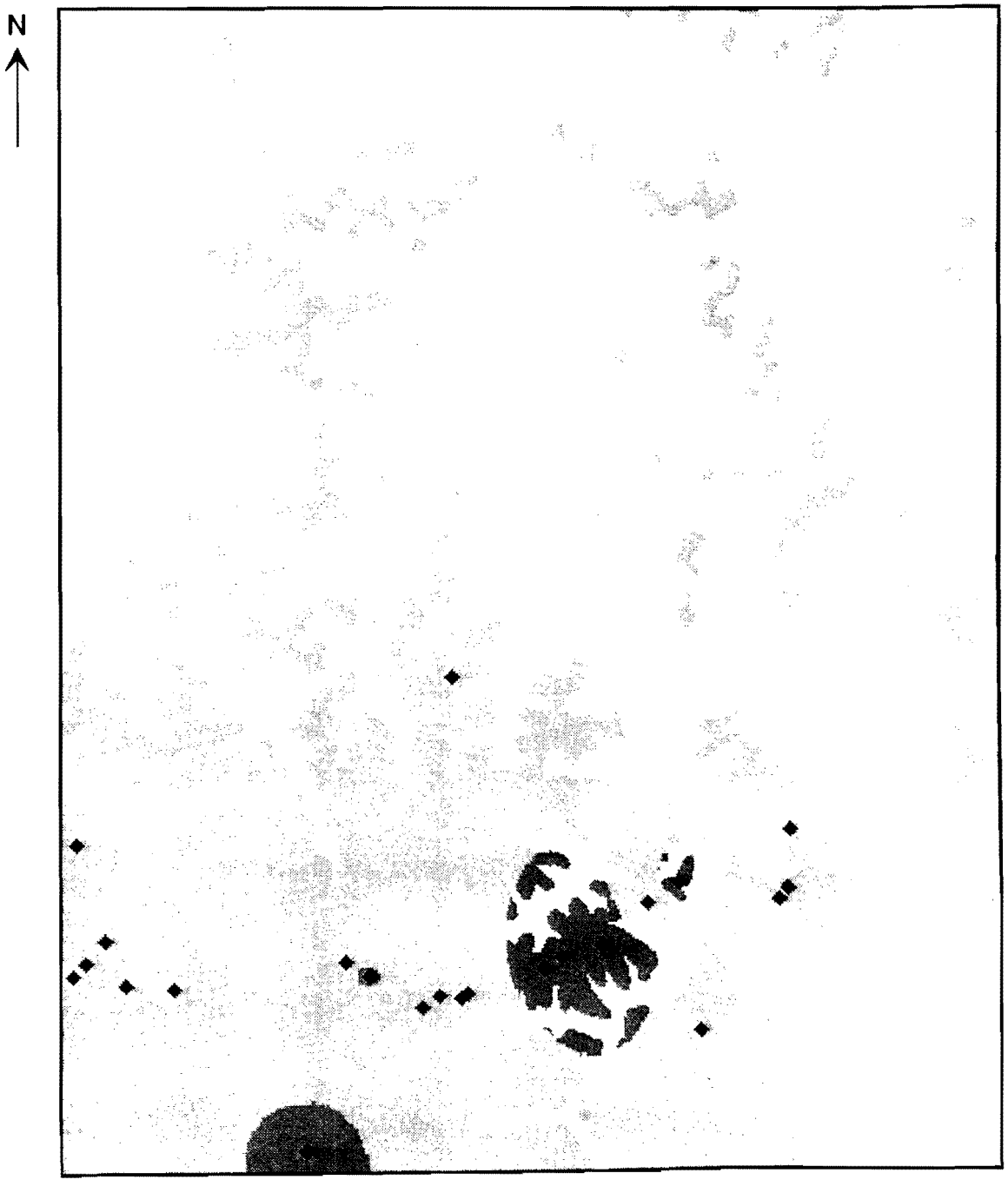
	0–100′								100–1,000′							
	14–28″				> 28″				14–28″				> 28″			
	MEAS	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*
Original	317	374	52	0	0	0	0	0	707	411	19	0	0	0	0	0
Mined-Out Surface	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mined-Out Deep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Remaining	317	369	52	0	0	0	0	0	707	411	19	0	0	0	0	0
Total Restrictions	1	37	1	0	0	0	0	0	707	411	19	0	0	0	0	0
Total Available	317	332	51	0	0	0	0	0	0	0	0	0	0	0	0	0
Land-Use Restrictions[2]																
Cemeteries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faults	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Powerlines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Railroads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Streams	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Towns	1	20	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Technological Restrictions[2]																
Deep-Mine Barriers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interburden < 40′	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	0	0	0	0	0	0	0	9	5	0	0	0	0	0	0
Coal Too Thin	0	0	0	0	0	0	0	0	707	411	19	0	0	0	0	0

MEAS=Measured. IND=Indicated. INF=Inferred. HYP=Hypothetical.

[1]Totals may not equal sum of components because of independent rounding.

[2]Total tonnage associated with each category. Sums of individual restrictions exceed the restriction total due to overlapping areas.

Prater B Coal Bed

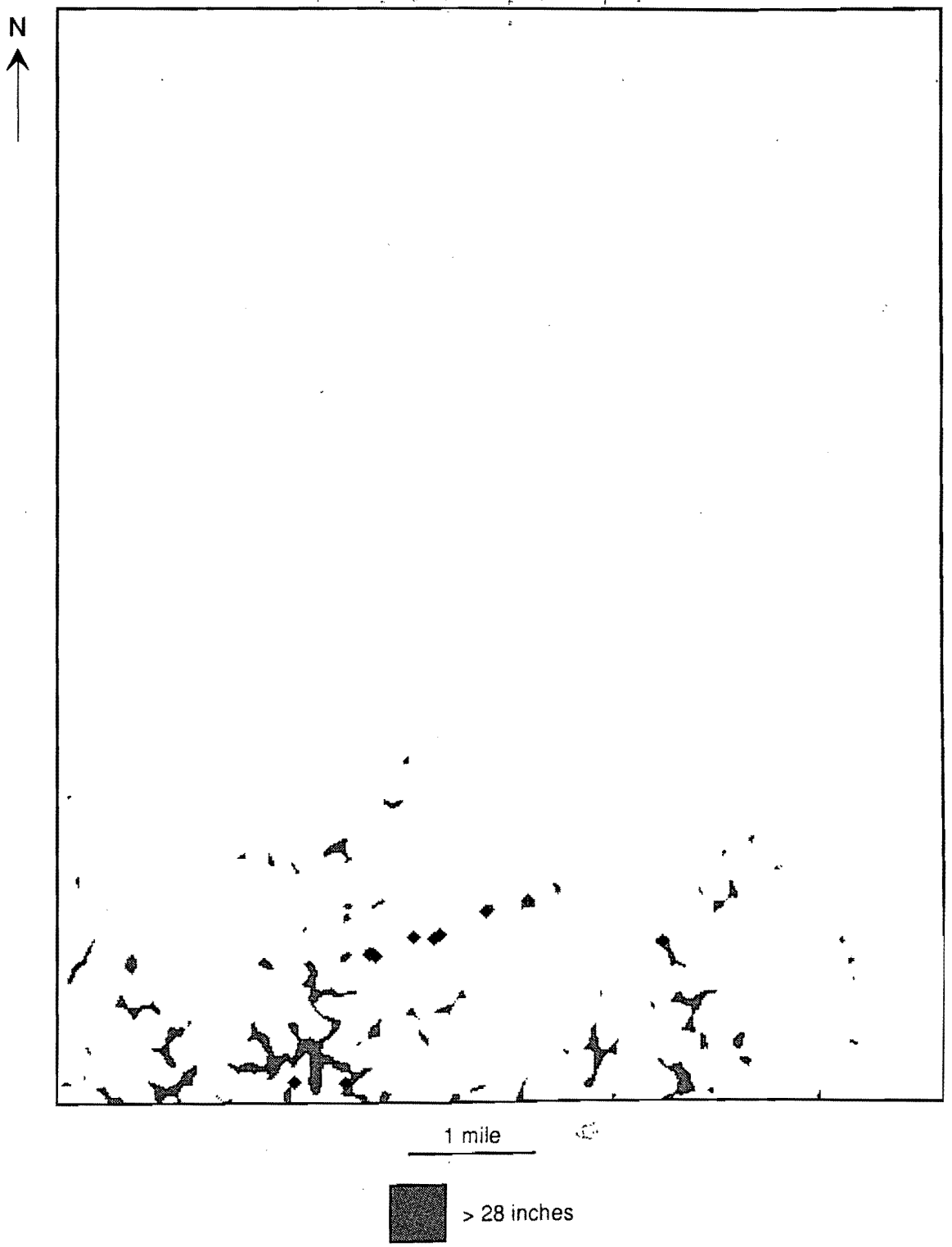


SKYLINE A COAL BED
Coal Availability Results
(Thousands of Short Tons)[1]

	0–100′								100–1,000′							
	14–28″				> 28″				14–28″				> 28″			
	MEAS	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*	*MEAS*	*IND*	*INF*	*HYP*
Original	2	0	0	0	700	1,090	1,012	0	0	0	0	0	0	0	0	0
Mined-Out Surface	2	0	0	0	465	636	536	0	0	0	0	0	0	0	0	0
Mined-Out Deep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Remaining	0	0	0	0	234	454	476	0	0	0	0	0	0	0	0	0
Total Restrictions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Available	0	0	0	0	234	454	476	0	0	0	0	0	0	0	0	0
Land-Use Restrictions[2]																
Cemeteries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faults	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Powerlines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Railroads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Streams	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Towns	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Technological Restrictions[2]																
Deep-Mine Barriers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interburden < 40′	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil & Gas Wells	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Too Thin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

MEAS=Measured. IND=Indicated. INF=Inferred. HYP=Hypothetical.
*Indicates measurements less than reported precision.
[1]Totals may not equal sum of components because of independent rounding.
[2]Total tonnage associated with each category. Sums of individual restrictions exceed the restriction total due to overlapping areas.

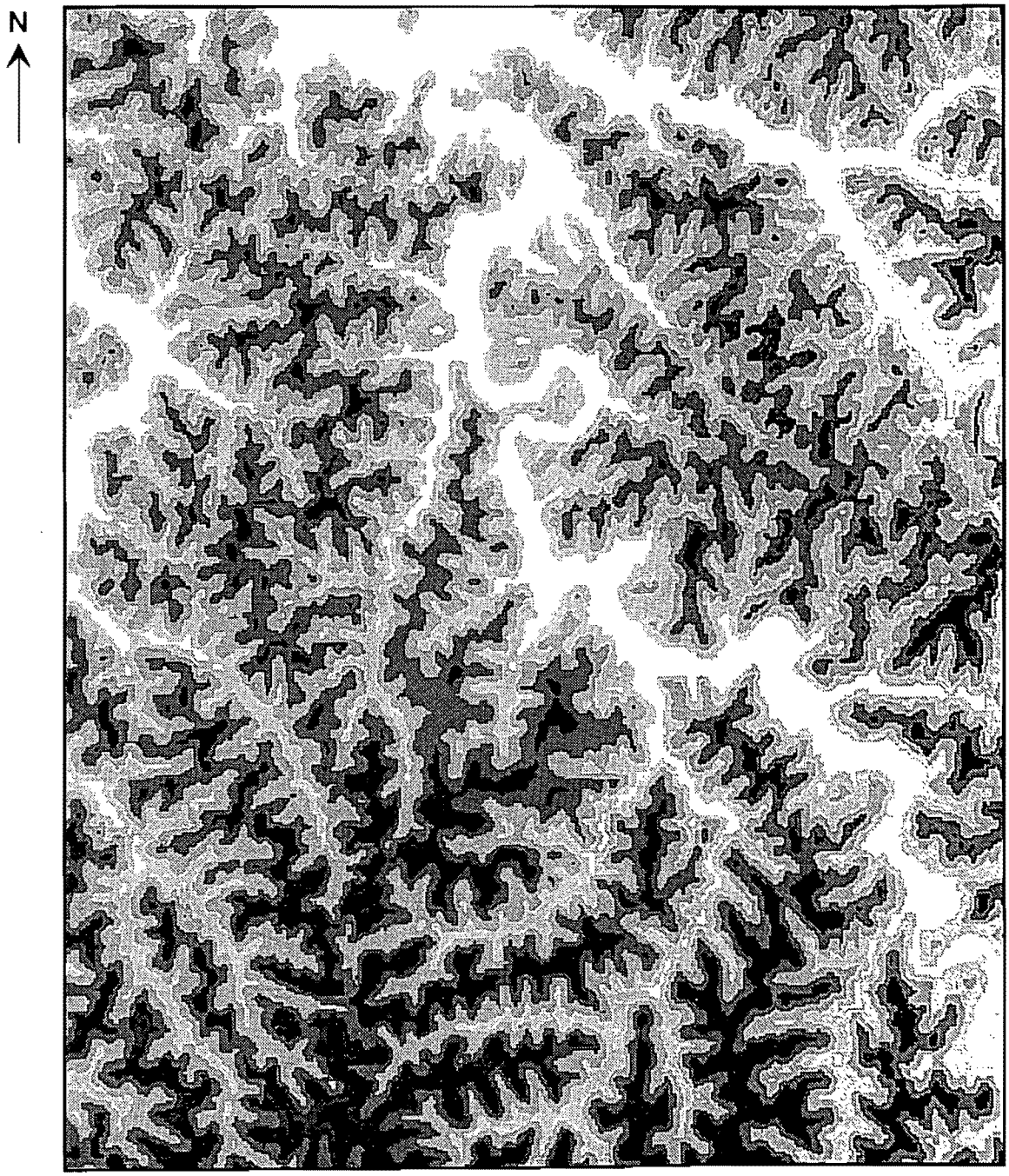
Skyline A Coal Bed



Diamonds indicate location of data points

APPENDIX B:
Maps of Digital Elevation Model and Restrictions

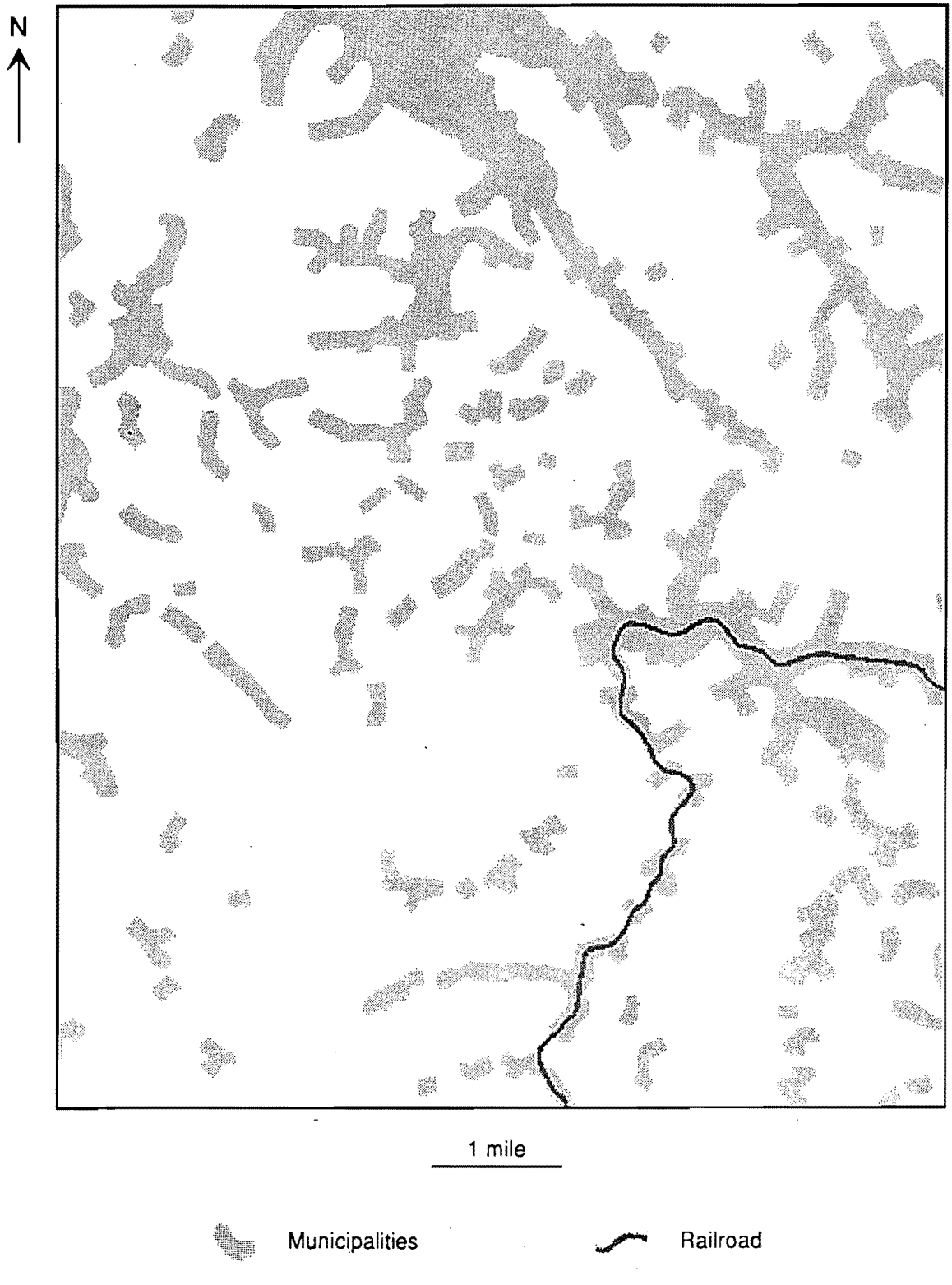
Salyersville South Digital Elevation Model



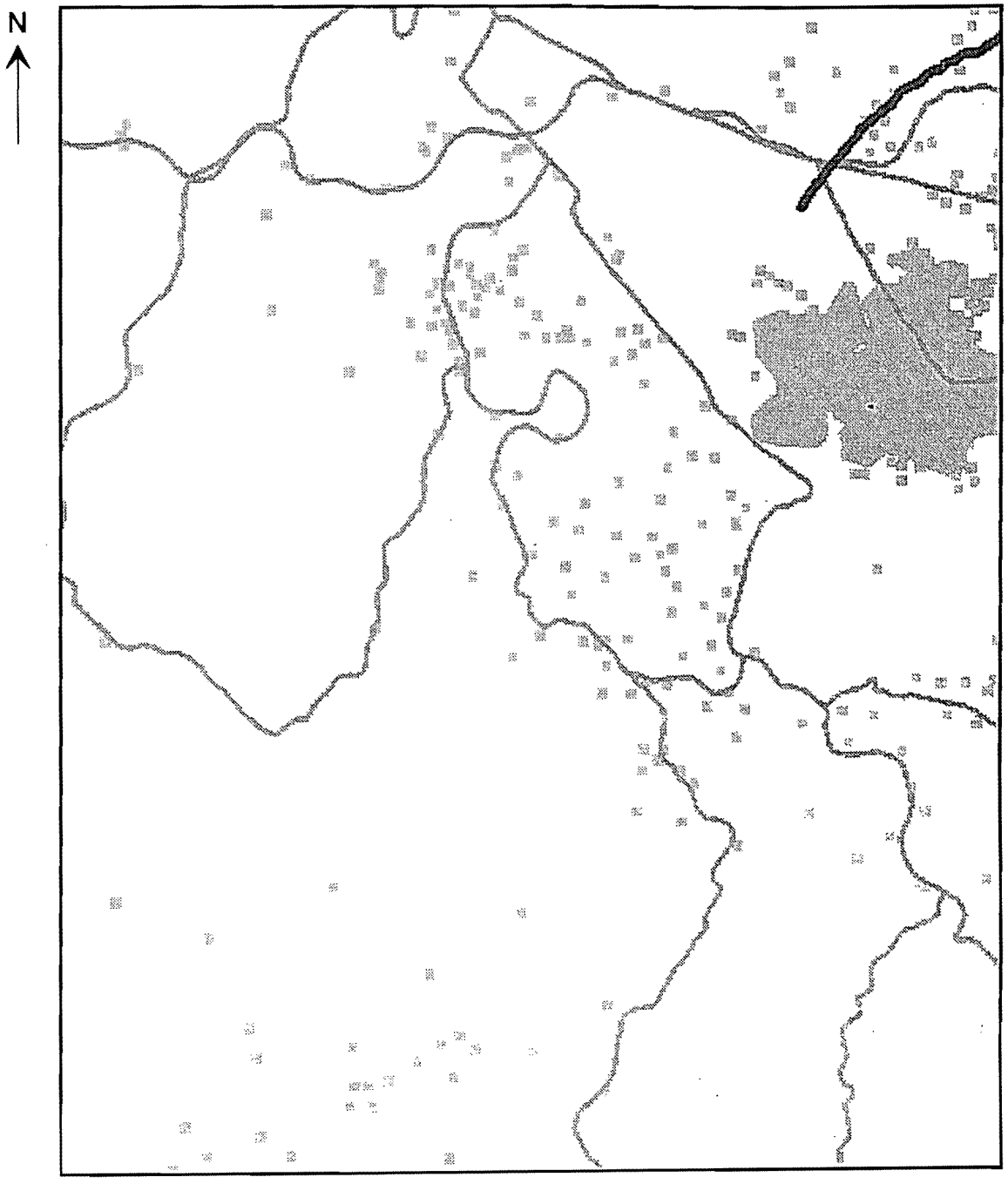
1 mile

Darker color indicates topographic highs

Salyersville South Restrictions and Appropriate Buffers



Salyersville South Restrictions and Appropriate Buffers



Salyersville South Restrictions and Appropriate Buffers